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Missouri Botanical Garden Bulletin

Vol. XVIII JANUARY, 1930 No. 1

CONTENTS

	Page
Forty-first Annual Report of the Director	1
Statistical Information	27
Floral Displays of Special Interest in 1930	

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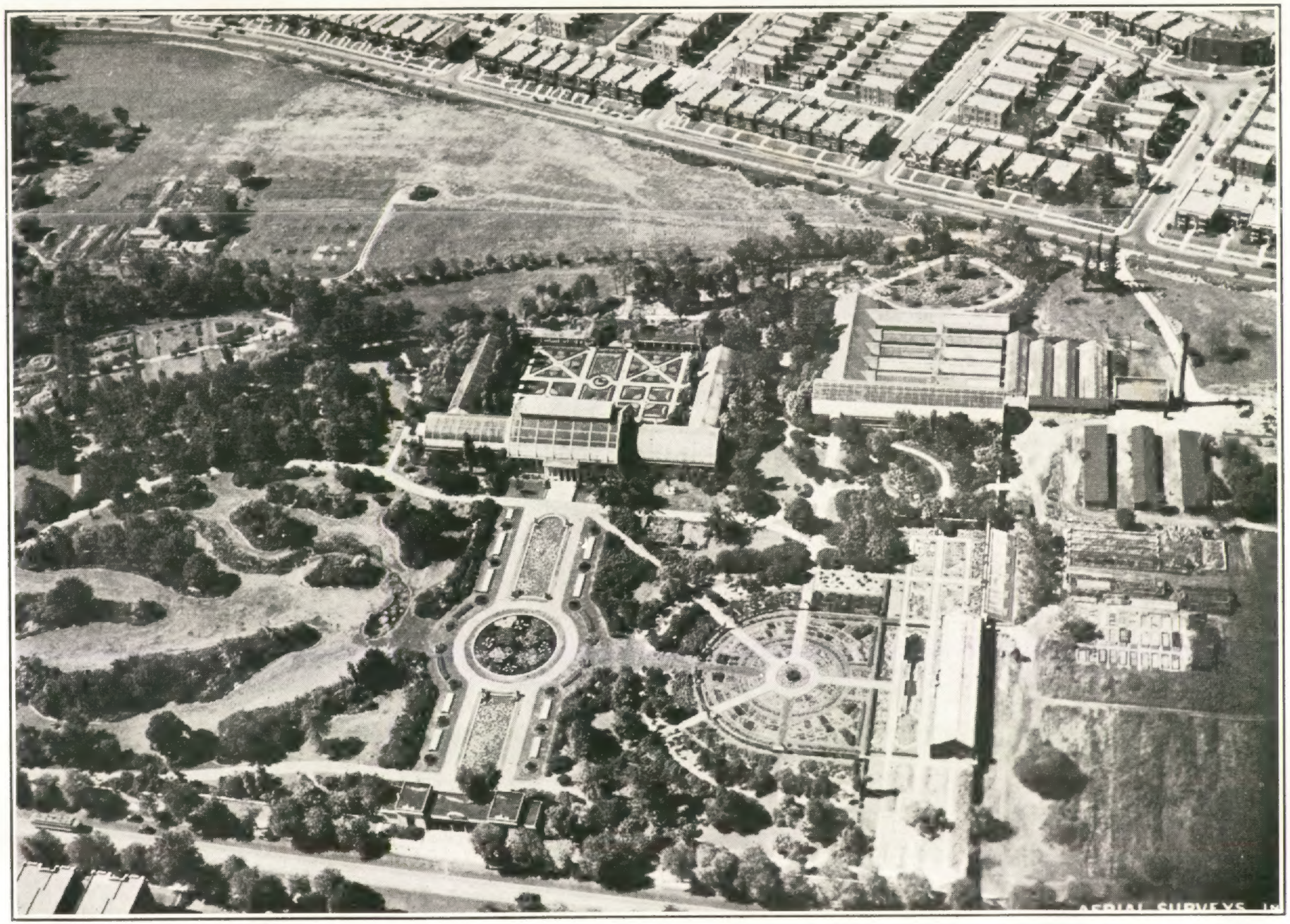

AIRPLANE VIEW OF NORTH HALF OF THE MISSOURI BOTANICAL GARDEN.

(Photo by courtesy of C. H. Butler, Aerial Surveys, Inc.)

Missouri Botanical Garden Bulletin

Vol. XVIII JANUARY, 1930 No. 1

FORTY-FIRST ANNUAL REPORT OF THE DIRECTOR

Gentlemen:

I have the honor to submit herewith the forty-first annual report of the Director.

Any one engaged in attempting to grow plants out of doors realizes what a factor the weather is in the success or failure of his efforts. While no one ever expects the weather in this climate to be ideal, during the growing season at an institution like the Garden the fluctuations come to be regarded as part of the ordinary routine which must be counteracted in the best way possible. It is not uncommon to read in reports from other institutions such statements as "The atrocious weather of the last two weeks has had a most disastrous effect on plants," but only when exceptional storms do unusual damage is it necessary that more than this be said. The snow storm of May 2, 1929, falls in this class, since the damage to trees and particularly to shrubs and herbaceous plants was very great, even exceeding that from the cyclone of September, 1927. Coming at a time when many plants were in full leaf, the heavy snowfall caused a type of damage quite unusual. Small plants which are ordinarily uninjured by storms were, because of the weight of the snow, snapped off at the ground, and no catastrophe which the Garden has ever suffered has caused so much damage to the smaller woody and herbaceous material. Trees likewise suffered, hundreds of them losing branches, in some cases the tops being broken out so as to disfigure them badly. The greatest loss was from

the disfiguration or practical destruction of trees fifty or more years of age of which the Garden possessed but a single fine specimen. A list of those most seriously damaged appeared with a brief account of the storm in the May BULLETIN. While such catastrophes may always be expected, they are always to be deplored. The possibility of having a tree which for fifty years has weathered all storms and grown to be a magnificent specimen destroyed in a few minutes or hours is one reason that the Garden is growing such large numbers of trees and shrubs at the Gray Summit Extension. Many of these in future years will be available for replacement purposes at the city Garden.

Another thing which makes for the success or failure of outdoor planting is the ability with which insect and fungous pests may be combated. The year 1929 is one which will long be remembered, because of the unusual number and ferocity of these plant enemies. It was only through the constant use of fungicides and insecticides that many trees and shrubs were prevented from being entirely defoliated. The acquisition of a large power sprayer capable of throwing a stream a hundred feet high was of the greatest assistance. It was in constant use, over sixteen thousand gallons of spray material having been used during the season.

Instruction in Gardening.—As was announced in the report of the Director for 1928, a change was made in the work previously offered in the School for Gardening so that short courses of a practical nature could be offered to those interested. These courses were planned to meet the needs and desires of amateurs in St. Louis, and covered such subjects as elementary gardening, identification of plants in the local flora, and vegetable growing. In addition demonstrations were held in the iris and rose gardens, and questions concerning propagation, pruning, diseases, fertilizers, etc., were discussed. There was also an afternoon devoted to creeping-bent grass lawns. Judging from the expressions of appreciation from those who registered for these courses the change has been well worth while. At least it has enabled a considerably larger number of amateurs in St. Louis to acquire the information of which they were in need, and a number of requests have already been made to have similar courses

offered during the coming spring. The number of people registered in all the courses totaled fifty, which was greater than the entire number of students in the School for Gardening for the thirty-eight years of its existence.

As has been the case for the past three years, a special course in elementary gardening extending throughout the school year has been provided for students in the School of Occupational Therapy. The article in the May BULLETIN on "Gardening and Its Relation to Occupational Therapy" discusses the subject at length. To meet the demand for trained gardeners capable of taking charge of private estates, or of entering park, cemetery, or country-club work, there was inaugurated at the first of the year a system of apprenticeships. There are at present five young men taking advantage of this opportunity, a number which exceeds the average yearly registration in the old School for Gardening.

Henry Shaw Museum.—It has long been recognized that there was no suitable place at the Garden for the display of the numerous portraits of Henry Shaw, together with articles associated with the early history of the Garden. With the abandonment of the old School for Gardening the lower floor of Henry Shaw's former country residence became available. This, besides being a most suitable place for such a collection, lends itself admirably for the purpose. The double parlors and the library across the hall have been redecorated, including the installation of two old crystal chandeliers. These were formerly in the reception room of Henry Shaw's town residence. The portraits of eminent botanists painted during the lifetime of Henry Shaw have been restored and, with the portraits of Mr. Shaw, practically cover the walls in the old residence rooms. Mr. Shaw's old piano, his desk, and minor pieces of furniture have been assembled here. An appropriately designed case occupies the center of the parlors, in which are displayed old record books, the diaries of Henry Shaw, and documents of historical interest. Here are also to be found early photographs of the Garden and the guest books in which Mr. Shaw always liked to have visitors to the Garden register their names and addresses. It is a matter of great satisfaction to be able to bring together amid such appropriate surroundings all of this material so intimately asso-

ciated with the life of Henry Shaw. While it probably will never be possible to open these rooms to the general public owing to the impracticability of accommodating large crowds, small groups of visitors who may be interested can always be admitted on request.

Outdoor Planting.—An unusually good display of pansies occupied the beds in the main garden for many weeks in the spring. The Darwin tulips have previously been grown in these beds, but this year they were planted in the Italian garden. The summer bedding material in the main garden consisted of coleus, alternantheras, castor beans, and *Centaurea gymnocarpa.* For the first time in many years the castor-bean plants were used in the circular beds, and they attracted considerable attention. In September the beds in this part of the Garden were planted with chrysanthemums, which commenced blooming in October and were a brilliant mass of color the first part of November. Many beds were planted with the various "Caprice" varieties, and probably not for years to come will there be such a wonderful display of these plants outdoors, due to there having been no killing frost until November 20.

The rose garden gave every promise of an abundance of flowers, but the heavy snow storm of May 2 ruined the bush plants. The leaves of the hybrid tea and hybrid perpetual roses were blackened, and while not all of the flower buds were injured, many failed to open. The climbing roses were not damaged to any great extent.

Without a doubt the Linnean garden in iris time presents a mass of color that cannot be produced by any other flower. The blooming period in this garden was extended by the four large beds of hollyhocks planted against the old brick wall. These were replaced by cosmos which continued in flower until the end of the season. The rearrangement of the formal lily pools immediately in front of the Linnean house necessitated replanting the iris around these pools. Only the better varieties were used, such as "Julia Marlowe", "Prospero", "Mildred Presby", "Taj Mahal", "True Charm", etc. Four large iris beds in the east end of the garden were also replanted with new varieties. Another large bed of Japanese iris was added, so that a display of these plants will

continue in this garden after the bearded varieties have passed.

During the summer months the Italian garden was very attractive, with its brilliant masses of foliage and flowering plants and the fine display of cannas.

In the economic garden the plot of cotton plants attracted many visitors. While cotton is grown in this garden every year, it received more notice the past season due to a write-up in the local press. A small section in the economic garden, originally planted with herbs, is now devoted to the peonies where a representative collection of named varieties will be maintained. Most of the herbs formerly grown here are now to be found in the medicinal garden.

Many new varieties have been added to the collection in the iris test garden, and its appearance has been improved by replacing the cinder paths with grass walks and a central gravel walk.

Unusual attention has been paid during the year to the care of trees and shrubs. Besides the routine pruning, much additional work was necessitated by the storm of last May, practically the remainder of the year being required to repair as far as possible the damage. Attention has also been paid to major tree surgery, and some of the larger trees have been treated in the most modern manner.

The medicinal plant garden aims to provide in so far as circumstances permit a separate bed for each particular species. Consequently the larger beds have been divided by means of additional grass walks. This not only provides for a greater variety of plants, but likewise adds much to the appearance of the garden.

The 1929 check list comprises some 300 medicinal plants. Much of the harvested material was utilized by the students in the pharmacognosy class of the St. Louis College of Pharmacy. Some 50 or more medicinal shrubs and trees were added during the past year, being a nucleus for what is hoped will be a rather extensive group to serve as the western border of the garden. The section devoted to tropical medicinal plants was likewise increased in size and number of specimens. Owing to unfavorable weather conditions many of these failed to make any decided progress, at least as com-

pared to those set out in 1928. The number of native medicinal plants for the state of Missouri is being rapidly increased.

Floral Displays.—The usual Christmas display of poinsettias and other brightly colored plants was carried through into the first of the year. The orchid show was installed the last Sunday in January and removed the first of March in order to make way for the annual spring show sponsored by the florists and growers of St. Louis. While the attendance did not reach the record established in 1928, the show was a creditable one, and on Sunday there were more visitors than could be comfortably taken care of. At the end of March the spring bulb display was arranged, and after the second week the new collection of azaleas was staged. This is the first time in a number of years that any considerable quantity of these plants has been shown at the Garden, and it was interesting to note how their reappearance was welcomed by the public.

Mention should be made of the flower show held in Boston, March 19-23, celebrating the one hundredth anniversary of the Massachusetts Horticultural Society. It is generally admitted that this was the most elaborate and beautiful flower show ever held in this country, surpassing in many respects the so-called national shows. Large sums were expended by individual exhibitors, their displays covering thousands of square feet, so that the small booth installed by the Garden, illustrating the growth of orchids from seed to flower, seemed insignificant. However, it attracted much attention and most favorable comment. A gold medal was awarded for the exhibit. The same display was forwarded to the national flower show at Buffalo, April 6-14, where it was again deemed worthy of a gold medal. At the dinner given by the president of the Massachusetts Horticultural Society the Board of Directors of the Garden presented an illuminated parchment conveying the congratulations and best wishes of the Missouri Botanical Garden. At the spring show of the St. Louis Horticultural Society, May 16-18, the Garden's exhibit of flowering orchids covered a space of 100 square feet.

Throughout the summer months the floral display house was devoted to a series of exhibits intended to give the public an idea of the varied activities of the Garden. This

exhibit was written up at length in the June BULLETIN and need not be further referred to here. Toward the end of October, instead of having a formal dahlia show, blooms were shown of some fifty of the newer varieties of dahlias from plants grown both in town and at Gray Summit. These had received awards of merit or for other reasons were of special interest. This display was followed by the annual chrysanthemum show, views of which appeared in the November BULLETIN. For the past few years an effort has been made to stage these plants in as natural a setting as possible. A Japanese-garden effect, produced with the aid of old stone lanterns, torii gates, bamboo and rush-thatched houses, has proved most satisfactory. While the inclusion of these decorative features involves much additional work, the effort seems to be worth while. Over 78,000 visitors came to view the show, and leading commercial and horticultural magazines throughout the country have published accounts and pictures of it. The show lasted until the first Sunday in December, when it was replaced by the regular Christmas display.

The Missouri Botanical Garden is the only institution of its kind in the world which makes such a feature of its flower shows. While many botanical gardens, as well as city parks, display various collections of blooming plants throughout the year, none of these has as yet succeeded in developing this feature to the extent that has been done at St. Louis. In fact, while a few of the larger cities of the United States have annual flower shows, these are maintained by contributions from a great number of amateurs and commercial growers. They submit most excellent displays which when grouped together give a beautiful and impressive effect, but only in St. Louis may one find a practically continuous display of blooming material through the fall, winter and spring months. It should be borne in mind that all of the plants shown, with the single exception of the three-day commercial show in the spring, are grown at the Garden. Considering the labor and expense involved in the elaborate settings now provided, it will be readily understood that the Garden is maintaining for the public a unique feature which is not equalled elsewhere.

ATTENDANCE FOR THE YEAR 1929
(Recording turn-stile count)

	Week-days	Sundays
January	3,877	5,392
February	11,838	16,354
March	17,556	29,002
April	19,934	9,656
May	17,796	18,152
June	23,899	11,715
July	21,586	11,231
August	25,903	17,966
September	15,576	17,914
October	21,671	13,481
November	30,269	48,596
December	7,276	6,852
	217,181	206,311
		217,181
Total		423,492

Construction.—One of the principal improvements during the year was the completion of the storm-water drain extending from the outlet of the lake in the North American tract along the line of Alfred Avenue to the inlet of the large sewer. This involved the laying of 855 feet of 36-inch pipe, with about 200 feet of smaller pipe connecting various drains and outlets. The elimination of the open ditch at the western boundary of the Garden has been long desired, not only because of the unsightly appearance of the stagnant stream, but also because it prevented proper grading and planting at this side of the Garden. This area is now for the first time attractively planted, and since Alfred Avenue has become such a thoroughfare the improvement is obvious to those who pass the Garden on the outside.

The completion of an adequate cold-storage house in which such plants as azaleas, roses, etc., could be carried through at the proper temperature for early spring forcing makes a welcome addition to the growing space. This house, which stands immediately north of the Linnean house and consequently is concealed from the main garden, will furnish material for staging even better floral displays.

The tropical pools in front of the Linnean house have been

entirely reconstructed. Originally built of brick, the action of frost during the past fifteen years finally rendered them almost useless. All of the old construction had to be torn out and replaced with reinforced concrete walls. Advantage was taken of the opportunity to change the design of the pools so that more direct walks could be provided leading from the rose garden to the Linnean house.

When the heating system was installed in the main conservatories concrete walls were built in front of the pipes so that earth could be banked up against them. Owing to the gradual subsidence of the soil during the past ten years the top half of this retaining wall had become exposed. Since this exposed portion was no longer necessary to retain the soil, it was thought that a much better circulation of heat would result if this part of the wall were removed. A beneficial effect was manifest almost immediately, it now being possible to maintain the proper temperature in the various houses with fewer coils turned on than formerly.

The 10,000 square yards of walks in the Garden previously treated with Tarvia were resurfaced during the summer, and about 3,000 additional square yards of walk, particularly in the Italian garden, medicinal garden and iris garden, received this treatment. All the walks are now in excellent condition and the thin film of mud which was so objectionable, particularly when frost was coming out of the ground, is entirely eliminated.

A new slat house was built for plants requiring shade while they are out of doors during the summer, as well as a cheese-cloth experimental house in which to grow a special collection of plants requiring protection. The main conservatory received two coats of paint outside, including the roof bars. Much inside painting was also attended to, and innumerable small construction and repair jobs taken care of. An unexpected expense was the replacement of most of the copper roof and gutters on the south end of the administration building. The original copper used was very light and apparently the hailstorm of 1927 contributed to its rapid deterioration. So many cracks and holes had developed that there was nothing to do but replace practically all of the old copper with new. It can safely be said that the physical

condition of the various glass houses and other structures at the city Garden was never so good.

Gray Summit Extension.—Considerable progress has been made during the year in the blasting of rock and grading incidental to the construction of permanent roads throughout the property. Large quantities of gravel obtained from the beds in the Meramec River have been used in road construction, as well as accumulated at convenient points where it can be drawn upon at times when the river is high or weather unfavorable for obtaining it. The site for the proposed rock garden has been cleared in preparation for future planting and much underbrush removed along the seven miles of trails now established. South of the administration building the old fence and accumulated rubbish have been disposed of and the unused corn cribs and sheds have been wrecked and removed. This greatly improves the appearance of the property in the vicinity of the administration building and at the same time opens up some very attractive vistas from this point. A garage and tool house with toilet has been built back of the administration building. Over 1,500 feet of footings for the stone wall along the Manchester Road was poured and hundreds of loads of weathered rock and boulders collected and hauled for use in the construction of the wall. Some 300 feet of this wall was built late in the year, and an idea can now be obtained of the great improvement this will make in the general appearance of the place.

Seeds of hundreds of varieties of new trees and perennials have been planted in the seed beds, necessitating the construction of some 500 lineal feet of additional beds. Innumerable seedlings have been transplanted to the nursery rows, and approximately 2,000 well-grown trees and shrubs are in the new nursery. Over 500 conifers from the nursery have been moved to their permanent location around the lake. Although this is a very small start compared with the thousands of evergreens which will ultimately make up the pinetum, even these few trees make a respectable showing and greatly improve the appearance of this part of the grounds. Forty-five hundred lily and narcissus bulbs have been planted among these evergreens. The rhododendron dell established last year has developed sufficiently to give

indication of what may be expected within the next few years. With over 2,000 of these plants in bloom, people visiting the Gray Summit Extension may see such a mass of rhododendron blossoms as has never before been possible in this vicinity. One thousand flowering cherry trees in some half dozen of the best varieties were set out late in the year, and next spring a thousand flowering crabs will be added to the collection. This will provide about twenty-five acres of blooming trees which, with the two apple orchards of twenty acres each, will furnish masses of beauty for future visitors.

The greenhouses, in which are maintained some 30,000 plants, are devoted almost exclusively to orchids. A few hundred of these plants are housed at the city Garden, and there are more than 5,000 plants at the Tropical Station in the Canal Zone. In addition to the commercial varieties which are grown primarily for the orchid show, there are hundreds of botanical species which are necessarily included in a collection such as is expected of a botanical institution.

Orchid Seedlings.—An effort has been made to increase the stock of spray orchids this year. With an almost unlimited quantity of choice and fertile seeds available, the results have proved satisfactory. There are many thousands of seedlings of the following genera in the flask stage, in community pots, and in one-inch pots:

Phalaenopsis Rimestadtiana	**Oncidium hybrids**
Phalaenopsis Sanderiana	**Saccolabium hybrids**
Phalaenopsis hybrids	**Miltonia hybrids**
Cymbidium hybrids	**Dendrobium hybrids**
Oncidium species	**Odontoglossum hybrids**

Vanda Sanderiana and *Peristeria elata* have been grown in great numbers and are vigorous and established seedlings. A Zygopetalum hybrid of select parentage is also a sturdy grower. The hybrid forms of the Cattleya orchid and its allied species are represented by thousands of seedlings in various stages of growth. These seedlings are the result of crossing very choice parent stock, many of which have received award-of-merit medals or first-class certificates from the Royal Horticultural Society. Efforts have been made to obtain white forms, yellow-flowering types, saffron, deep

mauve and delicate tints. The Potinera hybrids, which combine the characters of Brassavola, Sophronitis, Laelia, and Cattleya and are among the very finest orchids, have been produced in considerable numbers.

The seedling orchids are developing rapidly and require more and more space. The number of seedlings old enough to be transplanted to one-inch pots is approximately 10,000, while the number in earlier stages of growth approximates 50,000.

Tropical Station.—Mr. A. A. Hunter, the resident manager, reports that the garden at Balboa is looking and doing better than ever before. The trees planted by Mr. Powell are now large enough to furnish considerable shade, and new plants have been added as the result of the manager's trip to Chiriqui. This station continues to afford an excellent opportunity for the propagation of orchids and other plants which cannot be satisfactorily grown in St. Louis, as well as providing a tropical garden to which to send plants for recuperation which have begun to decline under St. Louis conditions.

European Representative.—Mr. Gurney Wilson, European representative of the Missouri Botanical Garden, continues to supply seeds and books which are much desired by the Garden and which cannot be obtained through ordinary channels. He likewise has been very helpful in adding materially to our collection of seed catalogues, particularly those of an early date which are now extremely rare. He was able to secure several hundred original sketches and finished drawings made by the late John Weathers, which he presented to the Garden. Weathers was formerly Secretary of the Royal Horticultural Society and is well known for his illustrations of various horticultural subjects, reproductions of his work being found in many English catalogues and magazines.

Annual Bequests.—The only annual bequest provided for in Henry Shaw's will, which was observed during the year, was the annual flower sermon to "commemorate the goodness of God as revealed in flowers." This sermon was delivered at Christ Church Cathedral, May 12, by the Rev. Phillips E. Osgood, D. D., Rector of St. Mark's Church, Minneapolis, Minnesota.

RESEARCH AND INSTRUCTION

The work in research and instruction has continued to go forward with the same intensity as in previous years, but with a larger number of graduate students; and with the increased number of students there has been an expanding interest and activity in cogent subjects. The laboratories at the Garden, accommodating the graduate students in morphology, taxonomy, mycology, and genetics, and the new laboratories in Rebstock Biology Hall on the University campus, planned especially for work in plant physiology, cytology, and certain phases of mycology, have been taxed during the year almost to their full capacity.

Dr. Mildred E. Mathias and Dr. Robert E. Woodson, Jr., have been appointed research assistants. Dr. Mathias has assisted in the work of the herbarium and in graduate instruction. Dr. Woodson, in the absence of Dr. Anderson, has conducted the course given to the pupils from the School of Occupational Therapy, and will devote a considerable portion of his time to the correct naming of the orchid collection, particularly those from Panama.

Research.—Dr. J. M. Greenman, Curator of the Herbarium and Professor in the Henry Shaw School of Botany of Washington University, has carried on his regular curatorial duties and continued investigations in the taxonomy of certain groups of plants, particularly studies of the Senecioneae, a tribe of the great family Compositae, and meanwhile has pursued the preparation of a "Flora of the Southwest". Dr. Greenman also has been continued in charge of graduate work, Shaw School of Botany, and has personally directed the work of graduate students majoring in taxonomy of vascular plants.

Dr. E. S. Reynolds, Physiologist to the Garden and Associate Professor in the Shaw School of Botany, has pursued his investigations on the toxic effect of certain plant extracts on fungi; he also is now occupied in researches which involve "Studies upon the causes of resistance to plant diseases" and "Studies upon the temperature of trees and its relation to external temperature". Dr. Reynolds also has directed the research work of the students majoring in plant physiology.

Dr. Edgar Anderson, Geneticist to the Garden and Assistant Professor in the Shaw School of Botany, has continued his investigation on the genus Iris. Dr. Anderson is now on leave of absence and is studying at the John Innes Horticultural Institute, London, England.

Dr. David H. Linder, Mycologist to the Garden and Assistant Professor in the Shaw School of Botany, has continued in immediate charge of the collections of fungi, and has done effective work in reorganizing the fungus material and reinstalling this part of the herbarium in new steel cases in the administration building. Dr. Linder in the meantime has continued investigations in his field and is now engaged in original research on "British Guiana Fungi Imperfecti" and "The structure of *Tremellogaster surinamensis.*"

Dr. Roland V. La Garde, Research Assistant, has investigated some of the problems involved in the non-symbiotic germination of orchid seeds, and in coöperation with the Director is engaged in carrying on certain work relating to soil acidity.

Dr. Mildred E. Mathias, Research Assistant, has pursued her monographic studies in the Umbelliferae, having devoted a considerable part of the past summer to field studies in gaining a first-hand knowledge of these plants in the living state, and is now completing "A monograph of the genus Cymopterus, including a critical review of related genera," which will appear in a forthcoming number of the ANNALS.

Dr. Robert E. Woodson, Jr., Research Assistant, completed a "Monograph of the genus Apocynum," which will appear in the next number of the ANNALS.

Instruction.—Undergraduate and graduate courses offered by the Henry Shaw School of Botany of Washington University in coöperation with the Missouri Botanical Garden for the college-year 1929-1930 were the same in number as in the preceding year, but with minor changes in the personnel of the teaching staff and in courses presented. Dr. A. M. Showalter was given charge of Botany 1 and the courses in cytology, and has directed the research work in cytology. Dr. Showalter has also continued his investigations on the Hepaticae, particularly on "Experimental studies in the genus Pellia". The total number of students in the Shaw School

of Botany has remained approximately the same as in 1927-1928, but the number of graduate students has increased.

Graduates, Fellows, and Scholars.—The following appointments have been made in the Shaw School of Botany for the academic year 1929-1930: Miss Martha L. Beardsley, A. B., M. S., Washington University, Instructor in Botany (half-time graduate student, Cytology, Physiology, and Mycology); Assistants in Botany (half-time graduate students), A. F. Bucholtz, B. S., Cornell University, M. S., Washington University (Plant Physiology), Miss Dorothy S. Francis, A. B., Radcliffe College (Plant Physiology and Morphology), and Harry J. Fuller, A. B., Washington University (Plant Physiology and Mycology); Rufus J. Lackland Research Fellows in Botany, Earl E. Berkley, A. B., University of West Virginia (Plant Physiology and Chemistry), H. H. Card, A. B., A. M., University of Illinois (Taxonomy and Morphology), George J. Goodman, A. B., University of Wyoming (Taxonomy and Morphology), Charles L. Hitchcock, A. B., A. M., Pomona College (Taxonomy and Morphology, and John T. Johnson, A. B., A. M., University of Illinois (Mycology, Taxonomy, and Morphology); Jessie R. Barr Fellows in Botany, Miss Marion Child, A. B., Oberlin College, M. S., Washington University (Mycology and Physiology), and Eva M. Fling Roush, A. B., A. M., University of West Virginia (Taxonomy and Morphology); Graduate Scholars, Miss Caroline K. Allen, A. B., Vassar College, M. S., Washington University (Taxonomy and Morphology), Miss Josephine Darlington, A. B., B. S. in Forestry, University of Montana (Taxonomy and Morphology), and Julian A. Steyermark, A. B., Washington University (Taxonomy and Morphology).

Degrees.—The following graduate students in the Shaw School of Botany received advanced degrees at the Washington University Commencement, June 11, 1929: Everett Fogg Davis, formerly Instructor in Botany, Washington University (Physiology and Pathology, Morphology and Mycology), Mildred Esther Mathias, Jessie R. Barr Fellow in Botany (Taxonomy and Morphology), and Robert Everard Woodson, Jr., Rufus J. Lackland Research Fellow in Botany (Taxonomy and Morphology)—Doctors of Philosophy; Miss Caroline

Kathryn Allen, Assistant in Botany, Washington University (Taxonomy and Morphology), Alexander Feodor Bucholtz, Rufus J. Lackland Research Fellow in Botany (Physiology and Cytology), Miss Marion Child, Jessie R. Barr Fellow in Botany (Mycology and Cytology), and Miss Julia R. Lawrence, Rufus J. Lackland Research Fellow in Botany (Taxonomy and Morphology)—Masters of Science.

Published Articles.—The results of research and investigation have appeared in the ANNALS OF THE MISSOURI BOTANICAL GARDEN, the quarterly journal which since it was founded in 1914 has so admirably served the members of the staff and graduate students of the Henry Shaw School of Botany as a place of publication. During the year four numbers of the ANNALS have been issued. Following are the titles of articles which have appeared in the ANNALS and elsewhere:

Anderson, Edgar. Variation in *Aster anomalus*. Ann. Mo. Bot. Gard. **16**:129-144, *pl. 4, figs. 1-3*. 1929.

Child, Marion. Preliminary Studies in the Genus Daldinia. Ann. Mo. Bot. Gard. **16**:411-486, *pls. 36-38, figs. 1-4*. 1929.

Davis, Everett F. Some Chemical and Physiological Studies on the Nature and Transmission of "Infectious Chlorosis" in Variegated Plants. Ann. Mo. Bot. Gard. **16**:145-226, *pls. 5-11, figs. 1-6*. 1929.

Greenman, J. M. Botany. (The American Year Book for 1928, pp. 711-713. 1929.)

Greenman, J. M. A New Variety of *Senecio aureus* L. Ann. Mo. Bot. Gard. **16**:405-406, *pl. 35*. 1929.

Greenman, J. M., and Eva M. Fling Roush, New Agaves from Southwestern United States. Ann. Mo. Bot. Gard. **16**:389-392, *pl. 32*. 1929.

Jensen, L. P. Pruning of Ornamental Shrubs. Parks and Recreation. **12**:130-131. 1929.

Jensen, L. P. Planting for Winter Effect. Parks and Recreation. **12**:171-173. 1929.

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Woodson, Robert E., Jr. Studies in the Apocynaceae IIIA. A New Species of Amsonia from the South-Central States. Ann. Mo. Bot. Gard. **16**:407-410. 1929.

Scientific and Popular Lectures.—The scientific and popular lectures given during the year before various organizations are as follows:

Edgar Anderson, January 4, before the St. Louis Horticultural Society, on "Courses in Gardening"; January 9, before the Botany Club of Soldan High School, on "How Plants Germinate"; May 1, before the science section of the Wednesday Club, on "The Great Conflict: The Rising Tide of Insects"; May 15, before the Women's Round Table, on "Plant Families"; May 24, before the P. E. O. of Webster Groves, on "The Rising Tide of Insects"; and on November 29, in London, before the Genetical Society, on "Variation in Two Species of Iris."

L. P. Jensen, January 4, before the St. Louis Horticultural Society, on "The Gray Summit Extension"; May 12, before the Junior Chamber of Commerce, on "The Missouri Botanical Garden Extension"; May 24, before the Osage Hills Garden Club, on "Native Plants"; June 7, before the St. Louis Horticultural Society, on "Growing Trees and Shrubs from Seeds"; June 14, before the South Kirkwood Garden Club, on "Wild Flowers"; July 1, before the Garden Club

of Gray Summit, Mo., on "The Gray Summit Extension"; July 7, radio talks over station KMOX, on "Wild Flowers of the Ozarks and Their Conservation"; August 4, before the Garden Club of Gray Summit, on "Transplanting of Woody Plants"; October 3, before the Faculty and Board of Directors of the St. Louis College of Pharmacy, and October 6, before the Garden Club of Gray Summit, on "The Gray Summit Extension"; November 1, before the St. Louis Horticultural Society, on "The Conservation of Native Plants."

Paul A. Kohl, January 4, before the St. Louis Horticultural Society, on "The Flower Shows at the Garden"; February 12, before the Garden Club of St. Louis, on "Flowers for the Cool Conservatory"; March 28, before the Garden Club of Springfield, Illinois, on "Plant Propagation"; August 2, before the St. Louis Horticultural Society, on "Iris and Iris Diseases."

Roland La Garde, November 7, before the class in gardening of the St. Louis School of Occupational Therapy, on "The History and Culture of Orchids."

Elinor Alberts Linder, January 4, before the St. Louis Horticultural Society, on "Orchids."

Mildred E. Mathias, December 31, before the Systematic Section of the Botanical Society of America, at Des Moines, Iowa, on "Generic and Specific Delimitation in the Umbelliferae."

George T. Moore, January 4, before the St. Louis Horticultural Society, on "The Missouri Botanical Garden"; January 19, before the Artists' Guild, on "Morality in Plants"; February 18, before the Kirkwood Garden Club, on "Some Activities of the Missouri Botanical Garden"; February 26, before the Scottish Rite Club, on "The Plant Commonwealth"; March 8, before the pupils of Cleveland High School, on "What Goes On Inside the Plant"; May 12, before the University Club, on "Morality in Plants"; June 3, before the St. Louis section of the American Chemical Society, and October 9, before the Parent-Teachers Association of the George Dewey School, on "The Plant Commonwealth"; November 19, before the Women's Overseas Service League, on "What Goes On in the Soil."

G. H. Pring, January 4, before the St. Louis Horticultural

Society, on "Orchid Collecting"; January 15, before the Webster Groves Home Garden Club on "Evergreens Suitable to Our Variable Climate"; January 22, before the Highland Woman's Club, on "Collecting Orchids"; January 28, before the Illinois State Florists' Association, on "Orchids and Orchid Collecting"; February 11, before the Women's Advertising Club, on "Orchids"; March 14, before the Cemetery Superintendents of St. Louis, on "Spring Work in the Garden"; April 2, before the Junior Council of Alton, Illinois, on "Orchids"; April 25, before the Fortnightly Club of Kirkwood, and May 1, before the Wednesday Club of East St. Louis, on "Cultivation of Orchids"; May 7, before the Business and Professional Women's Club of St. John's Episcopal Church, and May 13, before the Traffic Club of St. Louis, on "Orchid Exploration in the Andes of Colombia"; June 7, before the St. Louis Horticultural Society, on "Water-lilies"; October 8, before the Scottish Rite Club, on "Activities of the Missouri Botanical Garden"; October 22, before the Kirkwood Literary Society, on "Orchids"; October 23, before the West End Lions Club, on "Activities of the Missouri Botanical Garden"; November 4, before the St. Louis Retail Florists' Association, on "Commercial Orchids for the Retail Florists"; December 2, before the Garden Club of Gray Summit, on "Collecting Orchids in the Andes of Colombia"; December 10, before the Parent-Teachers Association of the Stix School, on "The Missouri Botanical Garden Floral Exhibitions."

E. S. Reynolds, January 16, before the Phi Sigma Biological Society, on "Disease Resistance in Plants"; December 28, before the Section for Cereal Diseases, American Phytopathological Society, at Des Moines, Iowa, on "Extracts of Flax Varieties Toxic to Fungi."

Hermann von Schrenk, November 21, before the engineering departments of the University of Illinois, on "Timber and Timber Preservation."

Fields of Activity.—The problems under investigation embrace primarily the fields of Cytology, Genetics, Horticulture, Morphology, Mycology, Physiology, and Taxonomy, in their various ramifications.

HERBARIUM

The year 1929 is outstanding in the equipment added, the growth, expansion, and reorganization of the herbarium. About the average amount of new material has been acquired during the year, but more than twice the usual number of specimens has been mounted and incorporated in the general collection.

The policy formulated several years ago of concentrating the herbarium's resources mainly in the Southwest has been continued, and valuable collections have been secured and progress made in the study of the flora of this region; but notable collections also have been obtained from various parts of the world, especially Mexico, Central America, South America, and southeastern Europe.

The rearrangement of the library and laboratories has made it possible to install additional new steel cases for the herbarium so that the collections of fungi have been transferred from the museum building to the administration building, thus bringing all the organized herbarium under one roof and affording case capacity for the much-needed expansion of the entire herbarium. This has greatly facilitated the use of the collections not only for members of the staff and research students, but also for visiting specialists consulting the herbarium.

New Accessions.—The larger and more important collections obtained during the year are the following: Dr. E. Anderson, 87 plants of eastern United States; Arnold Arboretum, 835 plants of eastern United States, collected by E. J. Palmer; Berlin Botanic Garden, 300 plants of Bolivia, collected by Dr. José Steinbach; Botanical Institute, Masaryk University of Brno, by Professor Podpera, 100 plants of Czechoslovakia; Botanical Museum, University of Cluj, by Professor Al. Borza, 200 plants of Roumania; W. E. Broadway, 300 plants of Trinidad and Tobago; Cornell University, by Professor K. M. Wiegand, 197 plants of New York; Dr. A. de Degen, 280 plants of Hungary; Professor D. Demaree, 500 plants of Arkansas; Professor J. A. Drushel, 154 plants of New York, New Jersey, Missouri, and Texas; Field Museum of Natural History, 990 plants from various regions, including Labrador, Illinois, Indiana, Mexico, Yucatan, and

Costa Rica; Dr. John Fogg, 155 plants of Massachusetts; Professor C. M. H. Glück, 275 plants of Germany; J. M. Grant, 107 plants of Washington; Dr. J. M. Greenman, 315 plants of Wyoming; A. A. Heller, 335 plants of Washington, Oregon, and California; Dr. William Herter, 172 plants of Uruguay; Dr. H. D. House, 72 plants of New York; Earl Lynd Johnston, 115 plants of Colorado; Professor Marcus E. Jones, 946 plants of Mexico; P. Jörgensen, 874 plants of Paraguay; John H. Kellogg, 238 plants of Missouri; B. Lynge, 77 plants of Nova Zembla; Dr. Mildred Mathias, 853 plants of Missouri and western United States; Mrs. Ynes Mexia, 262 plants of Alaska; W. Migula, 100 plants of Germany, Austria, and Switzerland; Professor G. Montero, 102 plants of Chile; T. K. Nyi, 51 plants of China; Professor L. O. Overholts, 125 plants of Ohio, Missouri, Colorado, etc.; 265 orchids transferred from the Panama Station of the Missouri Botanical Garden; Professor H. Pittier, 165 plants of Venezuela; Pomona College, by Professor P. A. Munz, 68 plants of California; Dr. C. A. Purpus, 150 plants of Mexico; Eva M. Fling Roush, 84 plants chiefly from West Virginia, Indiana, and Illinois; Rev. Frank C. Seymour, 100 plants of Massachusetts; Sofia University, by Professor N. Stojanoff, 100 plants of Bulgaria; Dr. José Steinbach, 798 plants of Bolivia; Miss Mary Stevens, 152 plants of Pennsylvania; Dr. H. Sydow, 200 fungi of Germany; Professor J. W. Thompson, 42 plants of Oregon; U. S. Department of Agriculture, by Professor A. S. Hitchcock, 100 North American grasses; U. S. National Museum, by Dr. Wm. R. Maxon, 223 plants chiefly from North America; Professor S. Venturi, 531 plants of Argentina; and Th. Oswald Weigel, 350 eumycetous fungi. In addition to the above, numerous smaller collections have been received from correspondents and friends of the Garden, which have been recorded in current numbers of the BULLETIN.

Mounting and Inserting of Specimens.—The mounting of specimens by the regular mounter has continued throughout the year. Extra help was employed for this work during the spring and summer months, and as a result nearly 30,000 specimens have been mounted during the fiscal year. The installation of additional cases and the expansion of the

herbarium have facilitated the interpolation of all this new material in the organized collection.

Exchanges. — Duplicate herbarium material numbering nearly two thousand specimens has been distributed to various herbaria and to correspondents with which the Garden maintains exchanges. The number of duplicate herbarium specimens sent to individuals and to institutions amounts to only about two-thirds of the number of similar material received by exchange during the same period of time. It is anticipated, however, that in a comparatively short time all obligations in this respect can be fully met.

Reorganization of Specimens in the Herbarium. — Much time during 1929, as in previous years, has been devoted to the reorganization of material already in the herbarium. Many specimens have been either remounted or the herbarium sheets cleaned, soiled genus covers replaced, labels amplified, and specimens rearranged in accordance with a definite geographical sequence. In this work the more advanced graduate students have rendered valuable assistance. The reorganized material not only greatly facilitates determinations, floristic and monographic work, but it enhances the scientific value of the collections.

Field Work. — A limited amount of field work has been carried on during the past year. The Curator made a small but interesting collection of plants in Wyoming, particularly on the Laramie Plateau and in the Medicine Bow Mountains; the research assistant made a notable collection in the southwestern United States. Important local collections have been added by the veteran collector, Mr. John H. Kellogg, a member of the Garden staff.

Use of the Herbarium by Outside Botanists.—It is noteworthy of record that of the constantly increasing number of visitors to the Garden, both laymen and specialists are making more and more use of the facilities of herbarium and library. Several loans of herbarium specimens, as in years past, have been made to institutions during the year for study by specialists and research students; and loans have been made to the Garden for study by members of the staff and by advanced graduate students in the Shaw School of Botany in connection with their research problems. All requests for

the loan of herbarium material for monographic study have met with the most cordial response by American as well as foreign institutions.

Statistical Summary (For the year ending December 31, 1929).

Number of specimens received on new accessions:			
By purchase	6643		
By gift	771		
By exchange	3407		
By field work	1363		
By transfer	265		
Total	12449	valued at	$1,244.90
Number of specimens mounted and incorporated	29494	valued at	$5,898.80
Number of specimens discarded from the herbarium	62	without value	
Number of specimens in organized herbarium	977795	valued at	$157,504.80
Number of specimens in unorganized herbarium	87584	valued at	8,758.40
Wood specimens, etc., supplanting the herbarium		valued at	280.00
Microscopic slides		valued at	410.00
Total valuation			$166,953.20

LIBRARY

The most important event in the library in 1929 was the acquisition of new space. For years the congestion in the library has been the main topic of the librarian's report, but during the past year the former lecture room at the south end of the building was fitted with 3,600 feet of steel cases, and the books on plant geography, systematic botany, algae, fungi, bacteria, and gardening were moved into this room. Already the room is so nearly filled that many wonder where the books were kept before this space was provided. Additional space was obtained in the periodical section by adding extra shelves to extend from the old cases to the windows. Although the time necessary for moving all the books, together with the checking and labeling incident to it, con-

sumed the greater part of the spring and summer months, the routine of the library was not interrupted.

The policy of discarding literature unrelated to botany has been continued during the year. A set of chemical serials, which was already available in at least two departments of Washington University, was sold at a considerably higher price than it had cost. In addition, about 150 volumes, representing chiefly government reports on education, civil service, minerals, etc., were returned to the government printing office at Washington. This elimination not only gives more space to the rapidly growing library, but when books are sold provides funds for purchasing useful botanical works.

In addition to the binding necessary to take care of current periodicals, etc., two itinerant bookbinders, who repaired some of the Garden books in 1928, were reengaged in 1929. These people brought all their equipment with them, and a corner of the old lecture room was set aside for their workshop. During the two weeks they were at the garden, 275 books were repaired or rebound at a considerably less cost than the work could be done elsewhere, with the additional advantage that the books could be consulted while being mended.

In July the ANNALS reprints were sent to the botanists on the Garden exchange list. Eight hundred and thirty reprints were sent to 285 individuals in this country and abroad, each receiving the publications in his special branch of botany. In exchange for these, the Garden library receives many important botanical pamphlets soon after they are published.

Use of the Library.—Besides the staff and students in the Henry Shaw School of Botany, the library was consulted during the year by the following out-of-town visitors, some of whom came to the city especially to refer to the Garden books: Prof. A. T. Erwin, professor of horticulture, Iowa Agricultural College; Mr. A. Saeger, teacher of botany, Kansas City Jr. High School, who recently published a monograph of a genus of the duckweed family compiled largely from Garden references; Prof. H. W. Rickett, professor of botany, University of Missouri, accompanied by some of the assistants and classes in botany from his institution; Prof. J. A. Drushel, of New York University; Prof. W. O. Richtmann, professor of pharmacognosy, University of Wisconsin;

Prof. G. H. Bretnall, accompanied by his class in botany, of Christian College, Columbia, Mo.; Dr. Carl G. Deuber, instructor in plant physiology, Yale University; Mr. Edward L. Evinger, of the Bureau of Plant Industry, U. S. Department of Agriculture. Out-of-town botanists also have the privilege of borrowing books on the interlibrary loan plan, and during the year 109 such loans were made to 28 institutions.

New Accessions.—Quite a feature of the Garden's accessions in 1929 was the collection of old horticultural literature which Mr. Gurney Wilson, the European representative, was able to obtain from time to time in England. Also the book catalogues have been listing some unusually desirable things, and recently several old Floras and a work on Mosses for which the Garden has been searching for years was ordered from a foreign dealer. Some of the important books obtained in 1929 were Roscoe's "Monandrian plants," published in 1828, Patouillard's "Tabulae analyticae fungorum," and Wizlizenus' "Memoir of a tour of northern Mexico connected with Col. Doniphan's Expedition." Some modern works of particular interest were the following: Cram, Modern loose-leaf atlas; Druce, Flora of Oxfordshire; Farlow and Burt, Icones Farlowianae; Hough, American woods, pt. 14; Index Londinensis; Proceedings International Congress of Soil Science, 2 vols.; Inzenga, Funghi Siciliana; Lemée, Dictionnaire descriptif et synonymique des genres de plantes phanerogames; Mayo Foundation Lectures on Plant Physiology and Pathology; Meisel, A bibliography of American history, Vol. 3; Morris and Eames, Our wild orchids; Seymour, Host index to the fungi of North America; Turrill, Plant life of the Balkan Peninsula; a reprint of Van de Pass, Hortus Floridus; Wilson, China, mother of gardens; and Walcott, North American wild flowers, Vol. 5. Due to the failure of a foreign publisher, some of the foreign continuations were not received in 1929. When this was discovered every Garden continuation was checked, and the missing parts written for. Many books and pamphlets, as well as serials, were received during the year in exchange for the Garden publications.

Garden Publications.—The four numbers of Volume XVI

of the ANNALS were issued in 1929. The volume is unusually large, containing 519 pages, 42 plates, and 31 text-figures. Eleven institutions were added to the ANNALS exchange list during the year, of which 1 was in Russia, 1 Poland, 2 Germany, 2 China, 1 Japan, 1 Canada, and 3 the United States. Volume XVII of the monthly BULLETIN was completed, with 167 pages and 39 plates. A new catalogue of the water-lily plants on sale by the Garden was also published in 1929.

The Garden has continued to receive an increasing amount of publicity not only from the local press, national and international news reels, etc., but from a variety of periodicals. In order to give some idea of the scope of the publicity outside of St. Louis, the names of some of the magazines which have printed either articles from the BULLETIN, original matter, or extended notices of the Garden, are listed:

Southern Florist
Florists' Review
Ladies' Home Journal
Flower Grower
American Iris Society Bulletin
Horticulture
Lorettine
Orchid Review
Florists Exchange
Park & Cemetery
Horticulture Illustrated
Pudor Seed Co. Catalogue

Statistical Information.—There have been donated to the library or received in exchange during the year 519 books valued at $1053.10, and 1036 pamphlets valued at $624.40. Three hundred and ninety-five books were bought at a cost of $2083.65, and 283 pamphlets at a cost of $411.95. Seventy-six volumes were sold for $485.00, and 147 books and pamphlets were discarded. The library now contains 44,810 books and 68,540 pamphlets. There are also 331 manuscripts valued at $1614.80 and 972,862 index cards valued at $11,582.22. A total of 9439 cards was added during the year, of which 1315 were written by Garden employees and 8124 were bought at a cost of $158.35. Three hundred and sixteen books were bound and 275 were repaired.

GEORGE T. MOORE,
Director.

STATISTICAL INFORMATION FOR DECEMBER, 1929

GARDEN ATTENDANCE:

Total number of visitors.....14,128

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought..... 75
Total number of books and pamphlets donated..... 94

HERBARIUM ACCESSIONS:

NOVEMBER

By Purchase—

Broadway, W. E.—Plants of Trinidad and Tobago..... 100
Purpus, Dr. C. A.—Plants of Mexico..... 150

By Gift—

Hitchcock, C. L.—Photograph of *Washingtonia filifera* H. Wendl 1
Husted, Miss Fanny Lou—Plants of Colorado..... 27
Roush, Eva M. Fling—Plant of horticulture..... 1
von Schrenk, Dr. Hermann—*Pinus rigida* Mill..... 1

By Exchange—

Botanical Museum—University of Cluj, by Professor Al. Borza—Plants of Roumania—Centuries VIII-IX, Nos. 701-900, incl. 200

Total 480

DECEMBER

By Gift—

Bush, B. F.—Mosses of North America..... 2
Deam, C. C.—Plants of Indiana..... 2
Heitman, Arthur—*Conocephalus conicus* (L.) Dum. from Missouri 1
Mallinckrodt, Edward—Plants of Alaska..... 2
Roush, Eva M. Fling—*Sidalcea* sp. from horticulture.... 2
Saeger, A. C.—*Lemna* from Missouri and Nebraska..... 4

By Exchange—

Sofia University, by Prof. N. Stojanoff—Plants of Bulgaria 100

Total 113

FLORAL DISPLAYS OF SPECIAL INTEREST IN 1930

In order that readers of the BULLETIN may have a more comprehensive idea of the various flower shows and outdoor exhibits which from month to month may be seen at the Garden, the following tentative schedule is given. While the indoor exhibits can be quite definitely indicated, the blooming period of outdoor plants is subject to variation, depending upon the weather, and out-of-town readers should confirm the date of any display before visiting the Garden.

JANUARY

(Floral Display House)
Orchids, Primroses, and Cyclamen.

FEBRUARY

(Floral Display House)
First half month—Orchids.
Second half month—Cinerarias.

MARCH

(Floral Display House)
March 8-17—Bulb Show.
March 20-23—St. Louis Florists' Show.
March 29—Azalea Show.

APRIL

(Floral Display House)
Azaleas, Roses, Schizanthus.
(Outdoors)
Pansies, English Daisies, Early-flowering Shrubs.

MAY

(Floral Display House)
Hybrid Pelargoniums, Salpiglossis, Begonias, Marguerites, Lupines, and other spring annuals.
(Outdoors)
Bulbs (early in month), Hardy Water-lilies, Peonies.
Iris (late in month), Spring-flowering shrubs and perennials.

JUNE

(Outdoors)
Roses, Hollyhocks. Medicinal Garden.

JULY

(Outdoors)
Tropical plants. Annuals. Economic Garden — farm crops, fiber plants, rice, cotton, peanuts, tobacco, sugar-cane. Medicinal Garden.

AUGUST

(Outdoors)
Tropical Water-lilies, Victoria Cruziana, Lotus lilies. Economic Garden. Medicinal Garden.

SEPTEMBER

(Outdoors)
Tropical Water-lilies. Economic Garden. Medicinal Garden.

OCTOBER

(Floral Display House)
Dahlia (novelties and newer varieties).

NOVEMBER

(Floral Display House)
Chrysanthemum Show.

DECEMBER

(Floral Display House)
Poinsettias, Stevias.

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove avenue and Flora place, on the Sarah car line (No. 42). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motorbus lines transfer.

STAFF
OF THE MISSOURI BOTANICAL GARDEN

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Director

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TROPICAL STATION, BALBOA, CANAL ZONE

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Manager

REPRESENTATIVE IN EUROPE

GURNEY WILSON, F. L. S.

Missouri Botanical Garden Bulletin

Vol. XVIII FEBRUARY, 1930 No. 2

CONTENTS

	Page
The Growing of Orchids from Seed	29
Control of the Bagworm	36
Spring Course in Gardening for Amateurs	40
Notes	41
Statistical Information	43

Floral Displays of Special Interest in 1930

ST. LOUIS, MO.
1930

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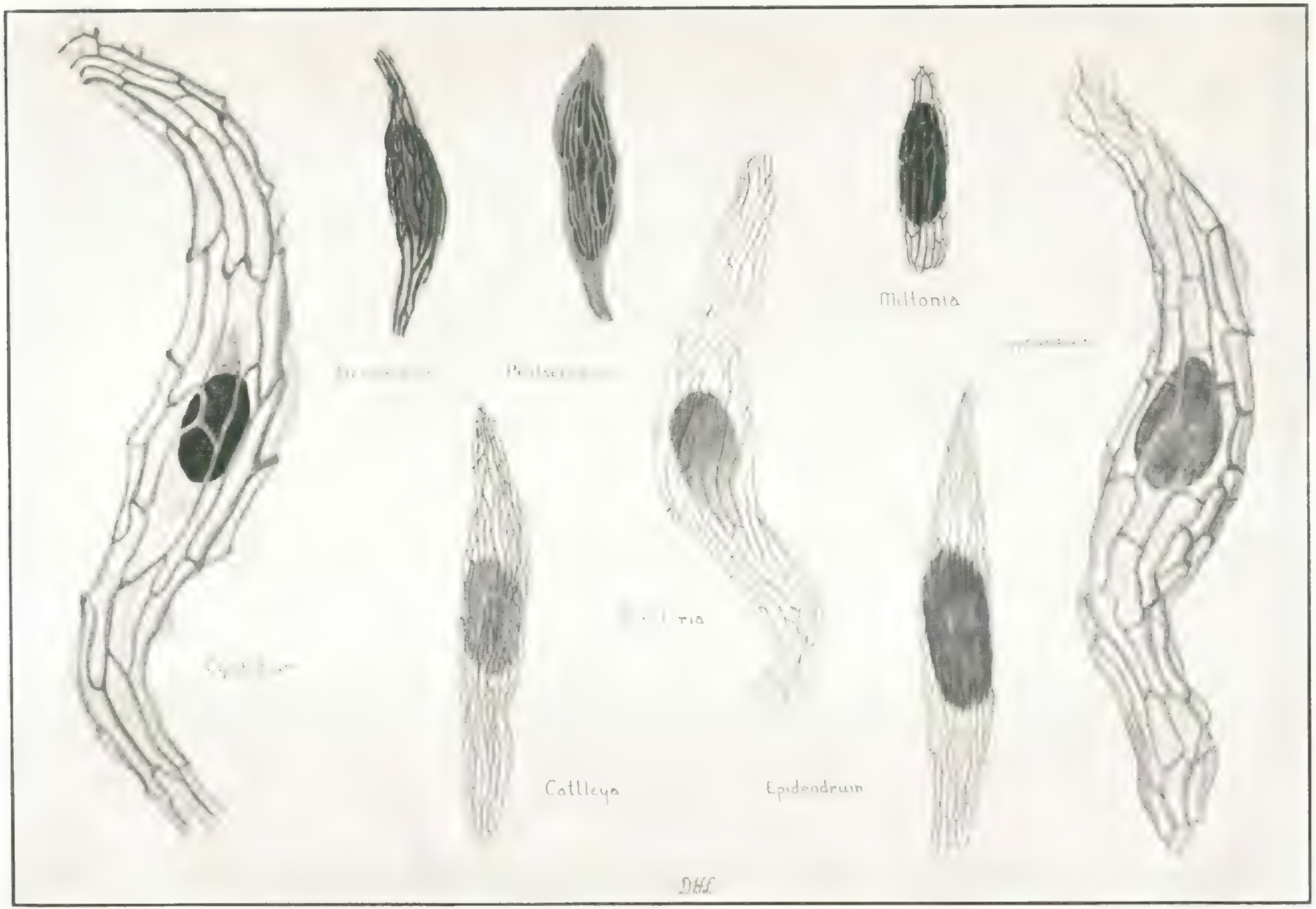


Seeds of different genera of orchids showing the characteristic structure of the seed coat. Magnified about 100 times.

Missouri Botanical
Garden Bulletin

Vol. XVIII FEBRUARY, 1930 No. 2

THE GROWING OF ORCHIDS FROM SEED

Orchids, in the minds of many people, are represented by those tropical flowers, mostly from South America, which are some shade of lavender, and are of relatively large size,—the flowers of the well-to-do. This is true in some cases, although a large number of tropical species from South America, Africa, and the Asiatic regions are inconspicuous and indeed may not even be recognized as belonging to the orchid family. For the true lover of orchids there is no necessity of going to the tropics, since during the months from spring until fall he may make an excursion to neighboring woods or meadows and there have the good fortune to discover, if they have not previously been exterminated by vandals, the pink lady-slipper, the snake-mouth, or the white or purple fringed orchid. Occasionally in the late summer months the rattlesnake plantain, with its clusters of delicate flowers lifted on slender stems above the beautifully mottled leaves, will reward the orchid lover's walk. Since home products are often little appreciated, or because wild orchids are not produced in the winter months when our desire for the most beautiful in the form of plant life is difficult to satisfy, the orchid greenhouse becomes a sort of earthly paradise.

In going through the greenhouses at Gray Summit (pl. 8), where plants are growing luxuriously, or viewing the magnificent flowers at the annual orchid show, it is difficult to realize the obstacles which frequently discouraged pioneers of the early nineteenth century and which to-day prevent many en-

thusiasts from attaining the success they desire. The large orchid flowers of lavender, white, yellow, or intermediate shades, in such great demand by the orchid collectors, were originally obtained from the tropics where they grew at almost inaccessible heights on the trees in little-frequented regions. Thus few people had seen these plants in their natural environment, and this fact added to the difficulty of the early growers.

At the time when orchid growing was truly horticultural pioneering, attempts were made to grow species, which were subsequently found to be epiphytic or tree-inhabiting, in the same manner as terrestrial species. This inevitably resulted in the death of the plants. Sir Joseph Banks, the famous English traveler and explorer, noticing that the plants grew on trees where they obtained a free circulation of humid air and only a little food material in the nature of decomposed leaves and washings from the upper parts of the trees, attempted to grow the plants in individual wicker baskets suspended from the roof of the greenhouse. His experiments were partially successful, and little by little improvements were made on this method. In 1841 Paxton devised the plan of fastening the plants to a piece of wood by means of a brass wire, placing a little moss around the roots to furnish permanent moisture. While this method was used by him in the Duke of Devonshire's greenhouses, nevertheless there continued to be a number of failures. At this time it was thought that all plants coming from the tropics and near the equator were accustomed to a uniform climate of considerable heat, but Lindley, in 1830, pointed out that there was the additional factor of high humidity to be considered. Consequently it became the practice to grow the plants under conditions of high heat and high humidity, but even then some plants fell by the wayside.

The reason some plants thrived and others perished was finally explained in 1835, when Joseph Cooper, the gardener of the Earl of Fitzwilliam, discovered that some orchids were being suffocated in the air-tight and too-warm greenhouses, a fact that was amply substantiated by the observations of various explorers in the tropics of different parts of the world. Thus it was noted that in such widely separated places as the

Orchid flower (*Cattleya Trianae*) showing desirable form for use in hybridizing. Note the symmetrical, well-rounded form and the erect position of sepals and petals.

Orchid flower (*Brassocattleya Hyca*) showing undesirable traits. The sepals and petals are narrow and show a tendency to recurve and thus to give a spidery effect.

MO. BOT. GARD. BULL., VOL. 18, 1930.

ABOVE: Orchid plant (*Cattleya Trianae*), bearing seed pod 10 months old. BELOW: Orchid plant (*Dendrobium Phalaenopsis*), bearing seed pods 8 months old.

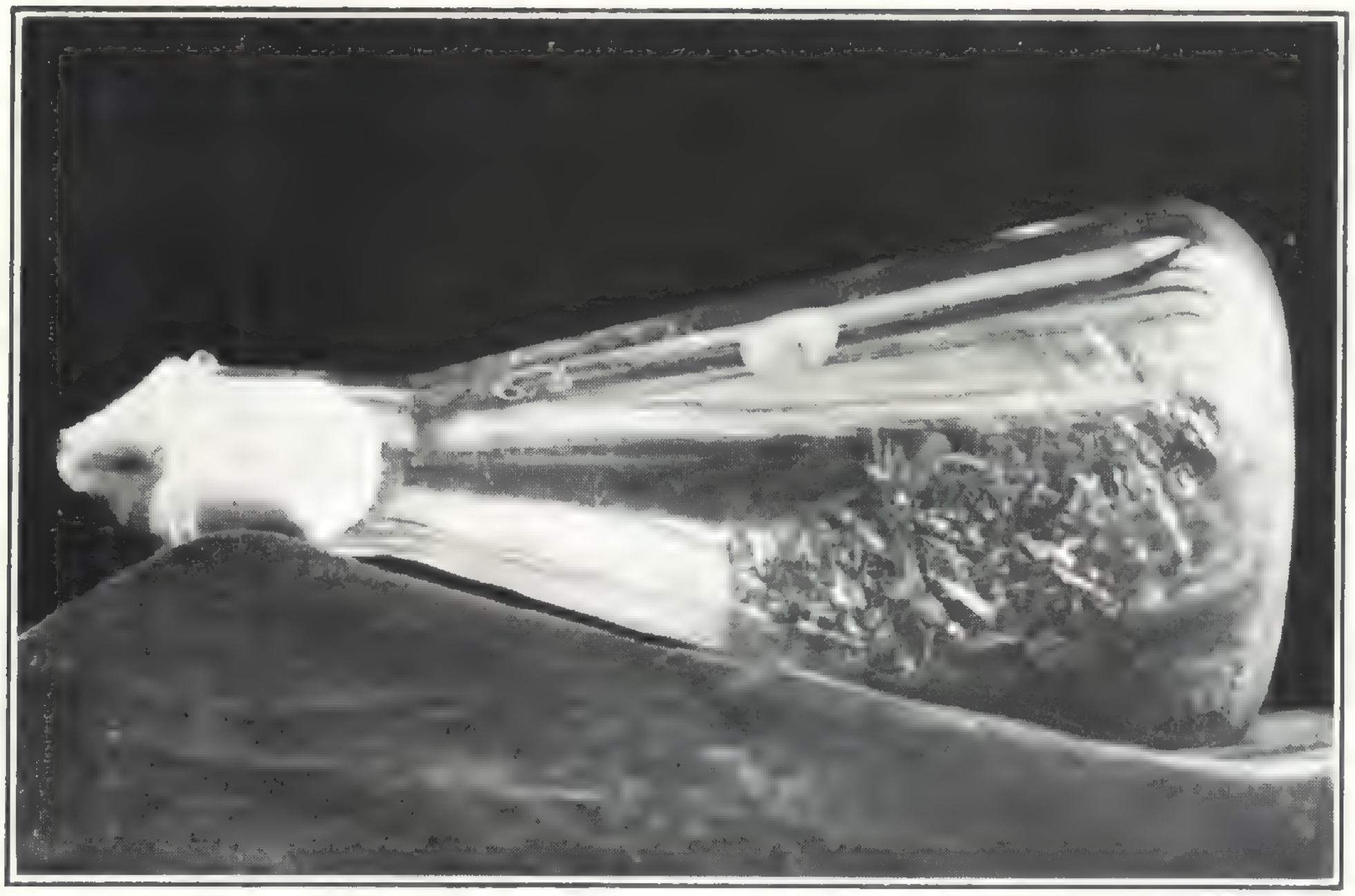
Peruvian Andes, the Khasia Hills in India, and the mountains of Java, even at the higher elevations where snow sometimes fell, beautiful orchid flowers were found. At last the reason for the lack of success in the culture of certain species of Cattleya and other genera was explained, and as a result greenhouses were soon divided into three categories, namely, the hot house, the temperate house, and the cool house. With the perfection of cultural methods and the corresponding increase in successful growers, there arose at the end of the nineteenth century a great demand for orchid plants and these were imported extensively by collectors in out-of-the-way places. Advantage was taken of the natural resting period of the plants during the dry season to send them back to the horticultural establishments of Europe, especially of England. Here they arrived in large numbers, actually or apparently dead. An occasional rare or exceptionally beautiful form was recognized among the survivors of the multitude, and these were eventually to become the parents of the exquisite and highly developed hybrids of to-day.

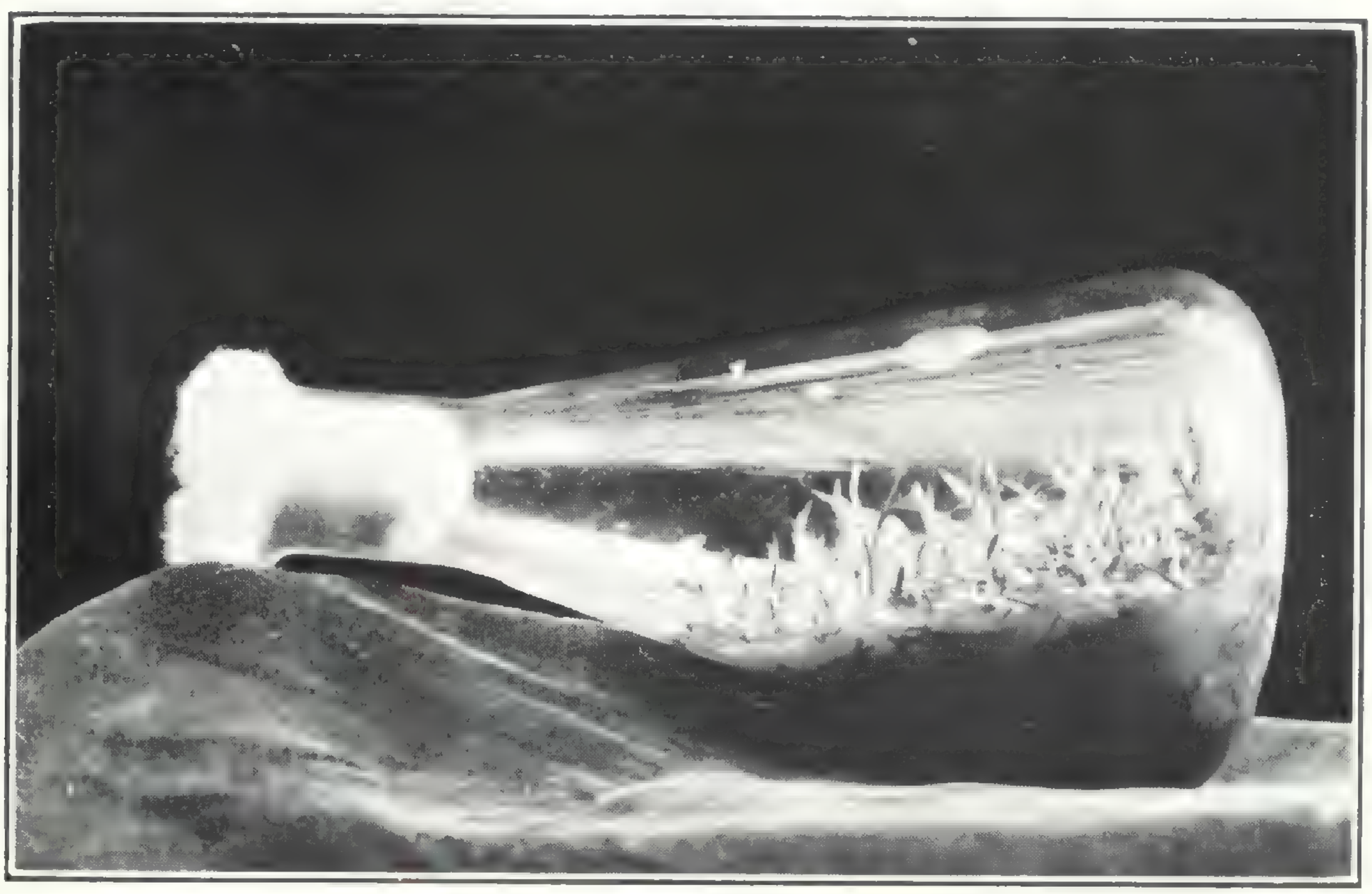
At first all attention was directed to the cultivation of the wild orchid species or natural hybrids, but Man was not for long content with Nature's efforts, for as early as 1856 the first artificial hybrid made its appearance. It was a cross-between *Calanthe Masuca* and *Calanthe furcata* and was named *Calanthe Dominyi* in honor of its originator, Dominy. Three years later Dominy produced *Cattleya Dominiana* by crossing *Cattleya maxima* and *C. intermedia.* This appears to be the first *Cattleya* hybrid. The first hybrid *Cypripedium* to flower was also a cross made by Dominy, and this was appropriately named *Cypripedium Harrisianum,* for Dr. John Harris, a surgeon who pointed out to Dominy the feasibility of hybridizing orchids. A succession of hybrids followed, produced by Dominy and his successor, Seden, in the Veitch establishment in England. Later others carried on the work, not only crossing Cattleyas but species of other genera, such as *Laelia, Cypripedium, Dendrobium,* and *Masdevallia,* to say nothing of crossing two related but distinct genera. The multiplication of hybrids has taken place at such a rapid pace that a filing system is needed to keep abreast of the times, there being something like 8500 registered hybrids all created

by the orchid breeder. Up to the present time, American orchid growers have been far behind Europe, and especially England, in the production of hybrids.

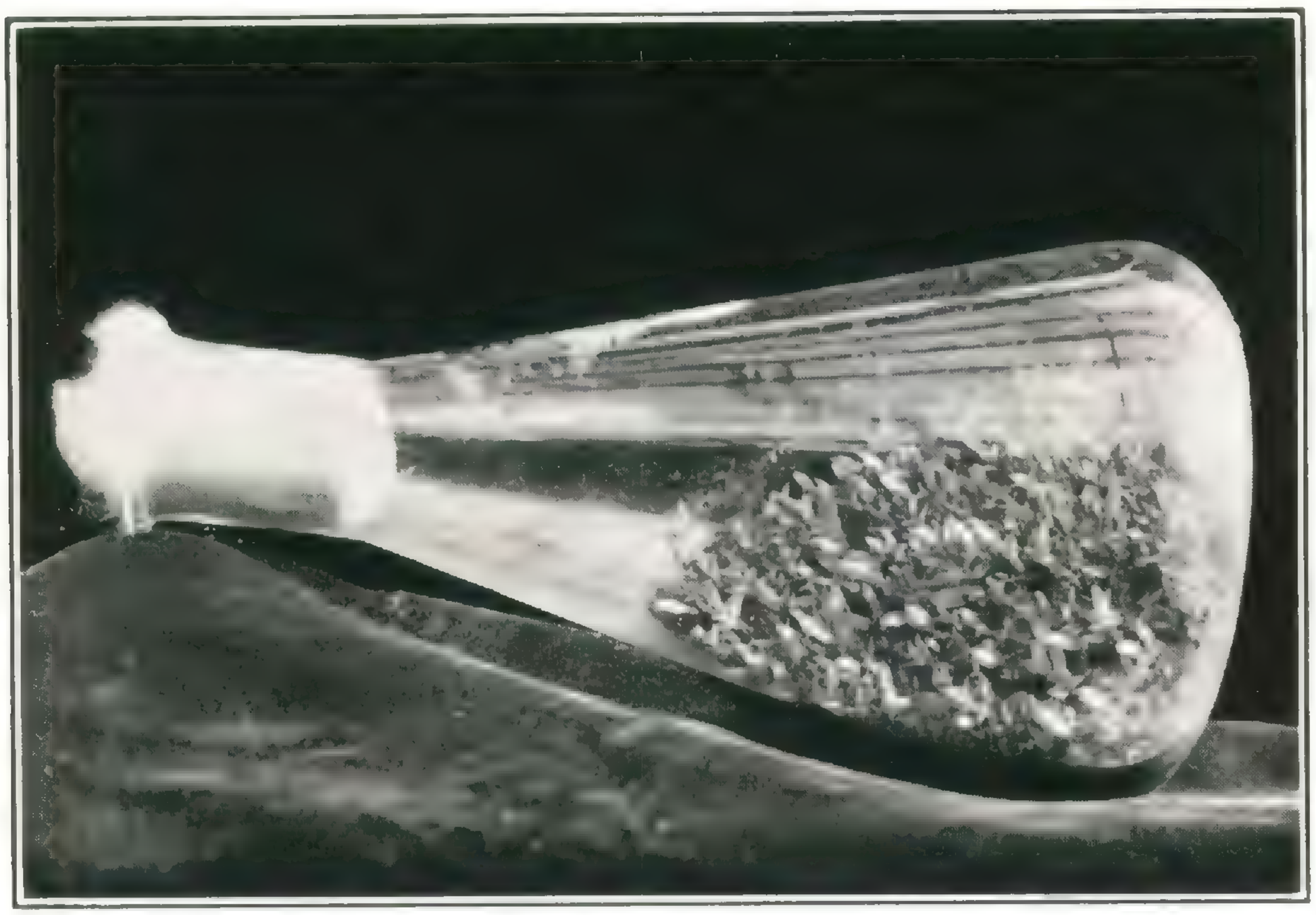
The orchid family is divided into a large number of genera which comprise somewhat over 15,000 species, and yet each year, as new and even more inaccessible regions are explored and our knowledge increases, new species are being added. A great number of the flowers of orchid species are of only average beauty, while a considerable number, to one of critical taste, are inferior and unworthy of further cultivation. Only very rarely is an individual flower discovered that possesses great floral beauty. The species, furthermore, are very similar in coloration and, however beautiful, are monotonous when cultivated in large numbers. The orchid hybrid is, in a sense, a creation having no counterpart in nature, possessing exceptional size, beautiful form, and entirely different and marvelous colors. The reason for this, providing the crosses are intelligently made, becomes obvious when it is realized that the hybridizing of allied species or even allied genera gives greater chances for variation in the resulting offspring. This is most clearly shown in the horticultural genus *Potinera* which combines the characters of *Brassavola, Laelia, Cattleya,* and *Sophronitis.*

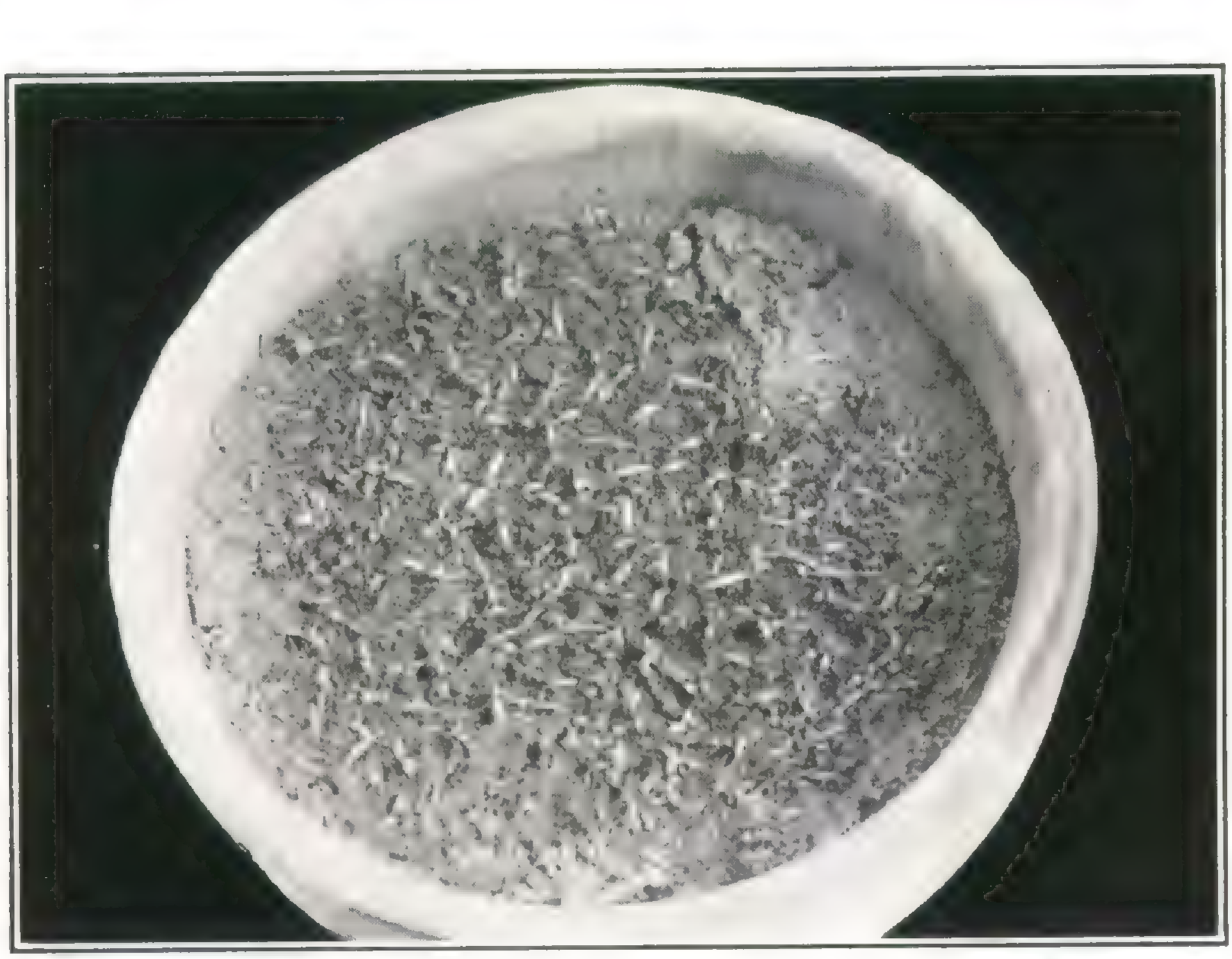
As a result of all this work, there are today, in addition to the popular lavender color, varieties with a wide range of very deep lavenders and intense purples, blue-lavender, bronze, orange, light and dark yellow, saffron, flesh tints, pink, pure white, and white with richly colored lips. Not only have the colors been somewhat changed or blended, but the shape has also been altered. In the wild species the petals are not infrequently narrow and strap-shaped, or if they are broad have some objectionable trait, such as recurving or drooping, or lack of texture. This last character, if it be transmitted to the hybrid offspring, makes the flower short lived. The commercial growers, in addition to requiring flowers that last, desire plants of great vitality that are easily grown and which possess the free-flowering habit. Those who grow orchids as a hobby, while recognizing the value of the preceding characteristics, aim also for perfection in form. To fulfill the requirements, the flowers should not have a spidery appear-





ABOVE: Dendrobium hybrid seedlings, 4 months old.
BELOW: Cymbidium hybrid seedlings, transplanted, 5 months old.





ABOVE: Brassocattleya hybrid seedlings, 3 months old. Original sowing that has not been transplanted.

BELOW: Dove orchid (*Peristeria elata*) seedlings, 5 months old. Transplanted to a community pot that contains a mixture of soil and peat.

ance. The petals should be so arranged as to fill the spaces and thus balance and make a symmetrical background for the ornamental and frequently brilliantly colored lip (pl. 3).

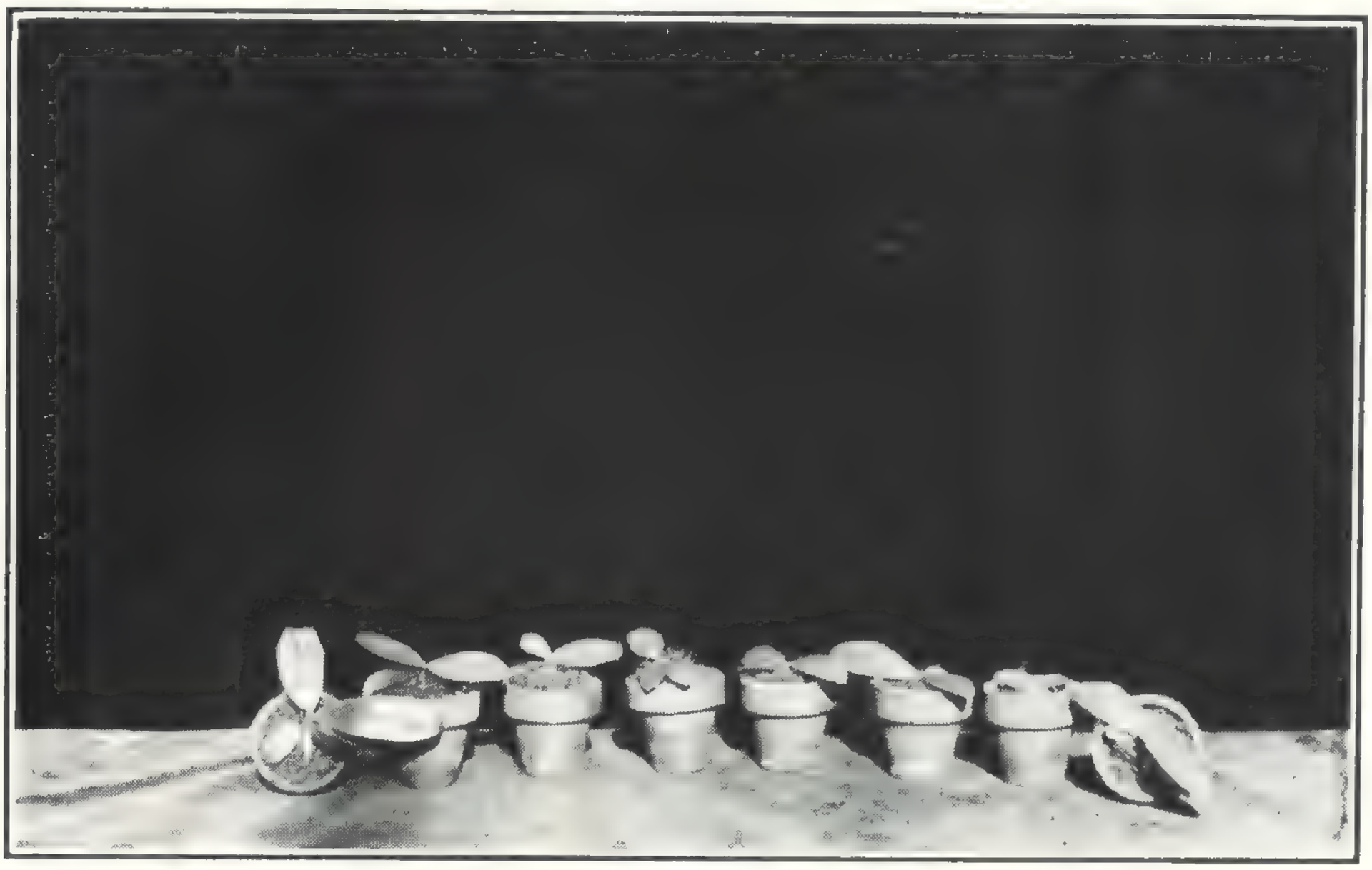
To approach perfection in the offspring, the selection of both parents, as has already been intimated, is of utmost importance, since in many cases undesirable traits appear to be dominant while surpassing beauty is recessive and occasionally may be lost unless reinforced by the other parent. For example, it is recognized that certain parents take on or impart color more readily than others, while still others take on or impart poor form or poor lasting quality. Occasionally, when comparatively mediocre stock is used for hybridizing, surprising results are obtained, due probably to the outcropping of recessive factors, but nevertheless a great proportion of success is to be expected when parents of finest quality are selected. With multi-generic hybrids, the chance for surprises is greatly increased, and this is what adds zest and fascination to the game of raising orchids from seeds. A parallel may be drawn from animal breeding. For example, in breeding race-horses, one would not go into a pasture and choose indiscriminately the parents of a future Derby winner. The chances are that instead of a Man o' War, a Spark Plug would be the outcome. However, the horse fancier has an advantage since the result of his breeding experiment becomes evident in two or three years, while the orchid grower must often wait six or seven or even ten years.

From the beginning of fertilization, approximately one year is required to obtain the mature seed pod (pl. 4), but the time may vary from six to eighteen months, depending on the species involved. Not infrequently, after the pod has matured, it will be found to contain nothing but sterile seed or chaff. The percentage of fertile seed, for some unknown reason, varies, even with the same parents, although there appears to be a positive correlation with the complexity of the crosses. The resulting fertile seeds are very minute (pl. 2), something like 30,000 being required to weigh as much as a single grain of wheat. The embryo contains very little reserve food material—insufficient to permit the seedlings to become well established unless the environment is most favorable for germination and growth. It is therefore evident that environmental

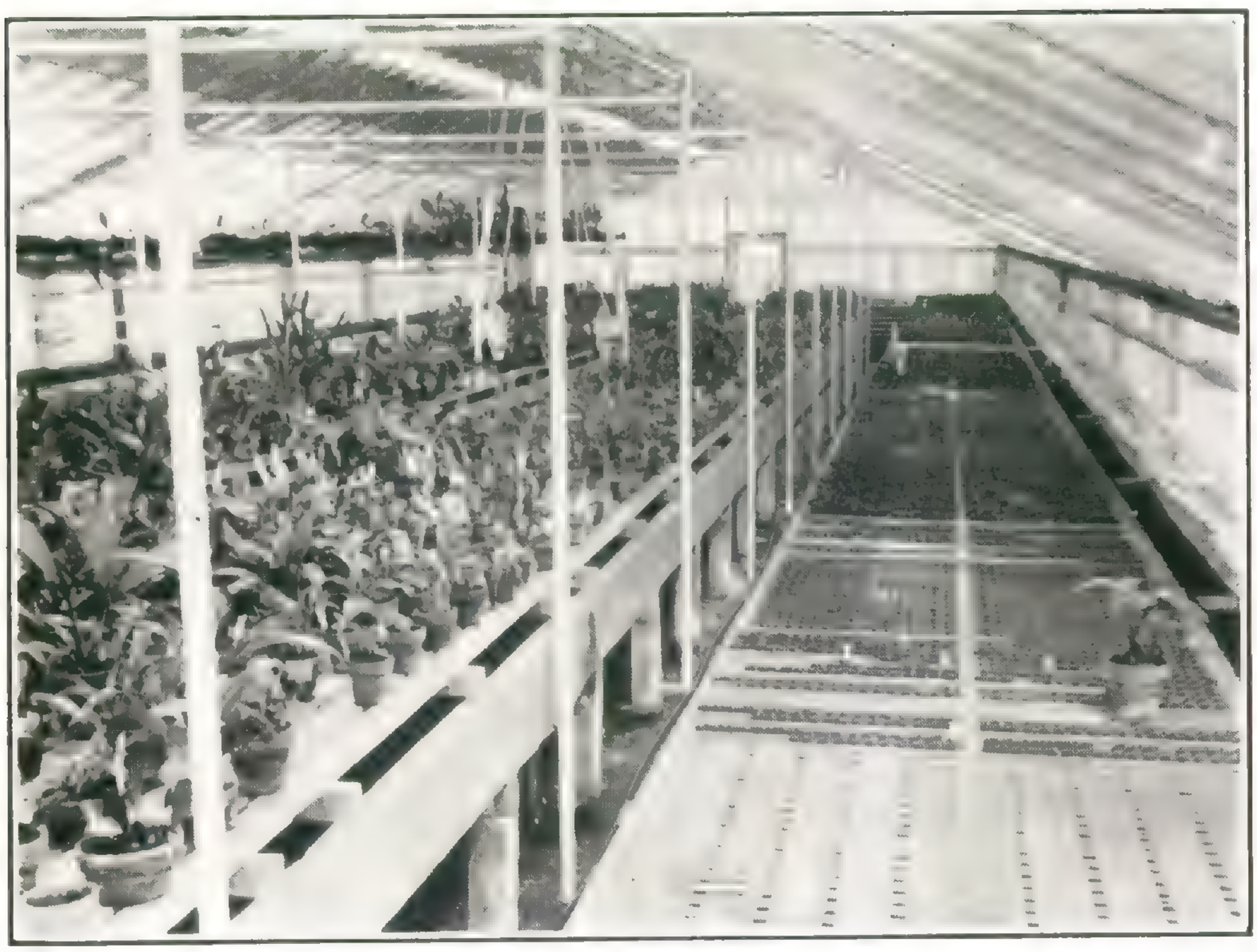
factors are important in determining the distribution and occurrence of the species in nature. Probably not more than one in a million of the seed produced results in a mature plant. Under artificial cultivation it is even more important that favorable conditions be maintained.

The early history of raising orchids from seed is full of more or less accidental discoveries. As a result of a series of scattered observations it became the custom to sow the seeds at the base of the parent plant, for it was evident that seeds thus sown germinated far better than those sown on a similar substratum that had not been in contact with the parent. The significance of these results was not appreciated until the end of the nineteenth century, when Wahrlich called attention to the fact that the roots of five hundred representatives of the orchid family, taken at random, all contained a fungus. Later Noel Bernard, who had made unsuccessful attempts to germinate the seeds of *Neottia*, the bird's-nest orchid of Europe, discovered during one of his field trips that the seed capsules of this species bent toward the ground and discharged the seeds upon the soil in the vicinity of the parent plant. These seeds had germinated and later when examined in the laboratory were found to be infected by a fungus. The presence of the fungus seemed to explain the relatively frequent success of the old method of germinating the seed in the vicinity of the parent.

The next step was to attempt to isolate the fungus, but this did not meet with immediate success. Although a fungus was isolated by Bernard and others, it was subsequently shown by Gallaud in 1894 to be not the true orchid fungus, but one not involved in the germination of the orchid seed nor in the welfare of the mature plant. After the publication of Bernard's paper, a controversy arose as to the necessity of the fungus. Some persons claimed to have had success without it, but when such cases were examined carefully it was found that only those seed germinated which had become infected by the fungus. It was later disclosed that those who had claimed success without the fungus had in reality infected the composts with the fungus from the roots. Thus the hit-or-miss fashion of sowing seeds at the base of the parent plant was succeeded by the method of sowing seed on Turkish towel-



ABOVE: Phalaenopsis hybrid seedlings in one-inch pots, 10 months old.
BELOW: Dendrobium hybrid seedlings in one-inch pots, 2 years old.



ABOVE: Interior of seedling house No. 5, at Gray Summit, showing hybrid seedlings in one- and two-inch pots. On the two left-hand benches, interesting although not always conspicuous, tropical orchids are growing.

BELOW: Interior of seedling house No. 2, at Gray Summit, showing hybrid seedlings in three- and four-inch pots. The two right-hand benches contain orchid seedlings in four-inch pots. These will bloom in two or three years.

ling or burlap that had been stretched over the surface of compost containing orchid roots. This method is often used to-day, even though the seedlings are liable to contamination by highly destructive fungi.

While Gallaud was the first to isolate the true orchid fungus, Bernard in 1903 led the way in the successful germination of orchid seeds in the presence of the fungus, on artificial media and in flasks. Later, in 1909, Hans Burgeff published the results of his successful experiments in which he employed essentially the same methods as Bernard. The use of flasks was a distinct advance over the old methods, since attacks by parasitic fungi and insects were avoided and the air about the seedlings could be maintained at a more even degree of humidity.

In recent years another method, known as the asymbiotic method of germination has been developed by Knudson and others. It receives its name from the fact that seeds are successfully germinated without the aid of fungi. This is in contrast to the symbiotic method in which fungi are employed. As a result of this development, two contending schools have arisen—the one claiming that the presence of the fungus is not necessary; the other contending that although the fungus is not necessary when proper sugars and other nutrient materials are supplied in sufficient quantities and in the right proportion, nevertheless the seedlings grow more rapidly and are more robust when the fungus is present. Furthermore, this second school believes that the symbiotic method more nearly duplicates the natural process. Which school may eventually prove to be correct remains for the future to decide, but it seems that if logical conclusions be derived from the ample evidence of many experiments and observations in the field, the symbiotic relation of fungus and host is a foregone conclusion.

In the work at the Garden, both methods are employed. The minute seeds are sown in flasks upon a specially prepared jelly containing nutritive salts. When the symbiotic method is used germination becomes evident within three or four days by the seeds turning green. The first leaf and a luxuriant growth of hair roots develop within one to three months (pl. 6, upper figure). The seedlings are then trans-

planted to another flask where they are allowed to remain until the root system is well established (pl. 5). This requires from five to six months. They are next potted in fern fibre in one-inch pots (pl. 7), carefully watered, kept in a humid atmosphere at a suitable temperature, shaded from the direct rays of the sun, and sprayed to discourage attack by insect pests and infection by fungi. At this critical period, the percentage of loss is about one per cent. After the seedlings outgrow the one-inch pots they are transplanted into a succession of larger ones (pl. 8) at varying intervals until at the age of six to ten years the plants mature and bloom, at which stage they are usually in five-inch pots.

The asymbiotic method, while having its use under certain conditions, is much slower than the preceding method. Germination takes place, instead of within three to four days, only after ten days to six weeks, depending on the species or varieties from which the seeds are obtained. However at no time during the first two to three years of growth do these seedlings become as vigorous as do those grown by the symbiotic method. The root system is slow in developing and the percentage of fatalities upon removal from the flask is generally very high.

Success in growing orchids from seeds, or even in growing the mature plants, depends largely upon the amount of care given to the plants. Over-enthusiastic beginners frequently make the mistake of killing the plants by kindness, which may be evidenced by too much watering, too little or too much sunshine, or other factors. Only through experience and continued observation can the requirements of the plants and an understanding of their needs be learned.

E. A. L.

CONTROL OF THE BAGWORM

In the March, 1921, BULLETIN there appeared an article under the title "Bagging the Bagworm" which gave directions for controlling this pest. This number of the BULLETIN has long been out of print but the demand for information concerning the bagworm is great enough to warrant reprint-

ing the major portion of the article, bringing it up to date in so far as remedial measures are concerned.

While the bagworm has been more or less prevalent in St. Louis for a number of years, the unusual number of these pests last spring, with the resulting cocoons, makes it probable that a considerable amount of damage to the trees may be anticipated during the coming season unless some systematic campaign is devised against them. The curious habit of the caterpillar of crawling about in a bag-like case makes it unusually conspicuous, and there are few trees in the city on which a careful inspection will not reveal, attached to the twigs, the old female bags, within which are the eggs for this spring's crop of caterpillars. The bagworm is often the most serious leaf-chewing pest of ornamental evergreens, attacking also nearly all of the deciduous trees and shrubs.

Immediately upon the hatching of the eggs the young caterpillar makes its way to the nearest leaf, where it begins to feed and construct a bag for itself. This bag consists of small fragments of leaves and bits of twigs held together by a large amount of silk spun by the caterpillar. The construction of this bag by the young larva is extremely interesting and well worth observing. Because of the soft body of the larva, the protective bag is needed throughout its existence, and as the caterpillar grows the case is constantly enlarged. About the end of August the caterpillar completes its growth and the bag is promptly attached to a twig. Additional layers of silk are spun within the bag, forming a cocoon, and here the transformation to the pupal stage takes place. In about three weeks after the cocoon is formed the male moth emerges from the base of the bag and flies about seeking the female. The female moth never leaves the bag entirely, although the head emerges from the lower end. Fertilization takes place within the bag, after which the female gradually works her way back into the chrysalis, which she then nearly fills with eggs. After accomplishing this the female forces her body through the opening in the bag, falls to the ground and dies.

Damage.—While the chief damage from this worm is of course the defoliation of the tree, an investigation of the effect of the construction of twigs by the bagworm, published in the Seventeenth Annual Report of the Missouri Botanical

Garden by Dr. Hermann von Schrenk, showed that the pressure exerted by the silken bands on twigs of coniferous trees was sufficient to cut off the food supply and that practically no growth took place in the twig on the sides below the bands. The portion of the twig above the band continued to grow for a considerable period, but that ultimately considerable damage might occur in coniferous trees seemed to be probable. In the hardwood trees investigated, with the exception of the locust, the pressure of the band was never great enough to obstruct the passage of elaborated food material. The strength which some of these bands showed was very considerable. The growth energy exerted by the twig, necessary to burst the band, of course varied very much with the strength of the individual band, but actual measurements showed that as high as 162 atmospheres was exerted in one case, and it is probable that in many cases at least from 30 to 40 atmospheres pressure was produced.

Collecting the Bags.—Since the eggs of the caterpillar are carried over the winter in the bag, the collection and destruction of these bags before the time of hatching is the most natural method which suggests itself of eradicating the worm. On small trees which can be thoroughly gone over with the aid of a short ladder, or by the use of a light pole pruner, such a method is recommended, provided all of the bags can be removed. However, unless this can be accomplished for all the trees, both large and small, over a very considerable area, results may be more harmful than beneficial, for the reason that at the time the eggs of the bagworm are destroyed the natural enemies of the caterpillar are likewise obliterated. Various flies which breed within the bag of the bagworm are parasitic upon the caterpillar and under favorable conditions are a very important factor in preventing the rapid spread of this pest. Consequently everything should be done to encourage the growth of the parasites. Of course, if only a small number of the bags is collected, the beneficial parasites which are destroyed might have ultimately been more effective than the elimination of comparatively few bagworm eggs. It is therefore advisable to keep the hand-picked bags in some sort of a receptacle instead of burning them. If a barrel is used for this purpose it should be covered with a

wire netting which will confine the caterpillars as they hatch out but will permit the numerous parasites to escape and be ready to assist in the control of the bagworms the following year. In general, then, the collecting of the bags is effective only where a comparatively few trees are infected, and it is not likely to be of much benefit when the pest is so widespread as it was in St. Louis during the past season. A striking example of the futility of this method is given by the late Professor C. V. Riley. He stated that for two consecutive months he worked attempting to keep a single cedar tree, not more than six feet high, free from caterpillars. Almost every day he found fresh specimens which he had overlooked at the previous visit, and he estimated that this prodigious number of caterpillars was the progeny of not more than two females.

Spraying.—Wherever appliances, capable of reaching all parts of a tree, whatever its size, are available, there is no question but that the use of some arsenical spray offers the only adequate means of combating the bagworm. If carefully carried out spraying will result in the destruction of all the bag-manufacturing caterpillars so that in the following winter there will be no bags to collect. Paris green has been used with good effect for this purpose, but powdered arsenate of lead, because of its great adhesiveness which prevents its being easily washed off by rains, is the poison generally employed. Any standard, well-known brand will be found satisfactory provided it contains not more than .05 per cent of water-soluble arsenic. Larger amounts cause burning of tender foliage.

When mixing a spray for a few trees or shrubs it is advisable to follow the maker's directions on the label, remembering to use the maximum rather than the minimum as suggested, especially if the caterpillars are nearly full grown. Most brands of arsenate of lead will give good control if one pound is mixed with each twenty gallons of water. To this solution should be added either calcium casenite or a miscible oil, obtainable at local seed companies (one gallon to two hundred gallons of water), to insure even distribution and adherence of the poison. The kind of sprayer, the season, and the efficiency of the operator, will all affect the amount of material necessary for any tree or shrub. Sufficient arsenate of

lead should be purchased to permit refilling the sprayer tank again and again until the trees or shrubs have been entirely covered. For medium-sized shrubs perhaps one-half gallon each will be enough. A tree ten feet high, having a spread of ten feet, may require three gallons. Later in the season these amounts may be doubled. In using a small hand-pump enough pressure should be maintained to produce a fog-like mist. Much more beneficial results can be obtained with this mist spray; a coarse spray forms heavy drops which run off. Both upper and lower surfaces of every leaf should be covered to give effective control.

Time of Spraying.—Owing to the great variation in the time at which trees leaf in different seasons, it is impossible to give any definite date on which the spraying should begin. The best rule is to begin to spray as soon as possible after the pest is first noticed. Much less spray is needed when the leaves are small and the young caterpillars are more quickly killed. Furthermore, it is extremely desirable to destroy the pest before serious damage to the young foliage is done. The amount of arsenic necessary to kill a full-grown caterpillar apparently varies greatly. It has been estimated, however, that a quantity of the powder equal to 1/4000 of the body weight of the caterpillar will stop its feeding in an hour or two and kill it in a few days. Even though poisoned caterpillars appear to recover, they often fail to pupate successfully.

SPRING COURSE IN GARDENING FOR AMATEURS

The success of the special courses in gardening for amateurs in 1929 warrants the offering of a new course this spring. The following outline indicates the general content of the course although changes may be made later to meet the special needs or desires of those constituting the class. The work will consist of talks, demonstrations and, as far as may be possible, the actual use of plant materials. While the course may be regarded as elementary, it is hoped that any who took the work last year will be able to find enough that is new to warrant their joining the course for the second season.

Those who may have had no previous course of this kind would be able to follow the work without difficulty.

Registration.—While no previous notice of intention to join the course is necessary, it would be advisable to notify the Garden office by letter any time before March 4. Registration will take place at the administration building, 2315 Tower Grove Ave., on Tuesday, March 4, at 3:45 p. m. The subsequent meetings will be held at the same hour on the dates indicated.

Fees.—A fee of $5.00 payable at the time of registration will be charged.

ELEMENTARY GARDENING

Tuesdays, 3:45 p. m.

March 4—Gardening books.
Catalogues.
March 11—Bulletins. Magazines. General care of plants including principles of growth. Soils and fertilizers.
March 18—Omitted on account of spring flower show.
March 25—Growing plants from seeds. Sowing seeds, transplanting, subsequent care. Propagating plants by cuttings.
April 1—Roses and irises.
April 8—Gladiolus, dahlias, bulbs, peonies.
April 15—Trees and shrubs and their care.
April 22—Annuals and perennials.
April 29—Hanging baskets, window boxes, trained ivies and philodendrons. House plants and their care.
May 6—Insects and diseases and their control.
May 13—General discussion of gardening problems.

NOTES

Mr. George H. Pring, Superintendent of the Garden, addressed the Cosmopolitan Club, January 21, on "The Activities of the Missouri Botanical Garden."

Dr. George T. Moore, Director of the Garden, attended a meeting in Chicago of the science advisory committee of the Chicago World's Fair Centennial Celebration, of which he is a member.

Dr. E. S. Reynolds showed motion pictures of plant life at the joint meeting of the Washington University chapter of Sigma Xi and the St. Louis Academy of Science, held at Rebstock Hall, Washington University, February 20.

Mr. L. P. Jensen, Arboriculturist to the Garden, gave an illustrated lecture before the St. Louis chapter of Alpha Chi Sigma, national chemical fraternity, February 10, at the Warwick Hotel, on "The Evolution of Landscape Art."

At the January meeting of the St. Louis Horticultural Society Mr. Anton Hogstad, Jr., Pharmacognosist to the Garden, spoke on "Vegetable Drugs"; and at the February meeting Mr. Paul A. Kohl, Floriculturist to the Garden, gave an illustrated talk on "Plant Germination from Seed."

Among the recent visitors to the Garden were Dr. L. H. Pammel, professor of botany, Iowa State College; Dr. Dow V. Baxter, assistant professor of forestry, University of Michigan; Mr. John C. Wister, president of the American Iris Society; Mr. C. C. Deam, state forester of Indiana; and Mr. F. E. Dixon, of Philadelphia.

Prof. A. T. Erwin, chief of the vegetable crops section at Iowa State College and a graduate of the School for Gardening of the Missouri Botanical Garden, was elected president of the American Society for Horticultural Scientists at a meeting of the society in Des Moines recently. The American Society for Horticultural Scientists is a professional society for research workers and professors of horticulture in the United States and Canada.

Mr. George H. Pring, Horticulturist to the Garden, and Dr. Robert E. Woodson, Jr., Research Assistant to the Garden, have left on a trip to The Tropical Station of the Missouri Garden at Balboa. The object of Mr. Pring's visit is a general inspection of the plants at the Station. Dr. Woodson is on a collecting trip for herbarium specimens and living plants of orchids, representing all possible species of the region.

STATISTICAL INFORMATION FOR JANUARY, 1930

GARDEN ATTENDANCE:

Total number of visitors	13,752

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	199
Total number of books and pamphlets donated	56

PLANT ACCESSIONS:

Total number of packets of seed donated	33

HERBARIUM ACCESSIONS:

By Purchase—

Herter, Dr. Guillermo—Plants of Uruguay	103
Jones, Prof. Marcus E.—Plants of Arizona	325
Purpus, Dr. C. A.—Plants of Mexico	50
Samuelsson, Dr. G.—Plants of Brazil, collected by Dr. P. Dusen	178

By Exchange—

House, Dr. Homer D.—Plants of New York	100
Jennison, Prof. H. M.—Plants of Tennessee	6
University of California, by Prof. E. B. Copeland—Plants of California, etc.	238
Total	1,000

FLORAL DISPLAYS OF SPECIAL INTEREST IN 1930

In order that readers of the BULLETIN may have a more comprehensive idea of the various flower shows and outdoor exhibits which from month to month may be seen at the Garden, the following tentative schedule is given. While the indoor exhibits can be quite definitely indicated, the blooming period of outdoor plants is subject to variation, depending upon the weather, and out-of-town readers should confirm the date of any display before visiting the Garden.

JANUARY

(Floral Display House)
Orchids, Primroses, and Cyclamen.

FEBRUARY

(Floral Display House)
First half month—Orchids.
Second half month—Cinerarias.

MARCH

(Floral Display House)
March 1-17—Bulb Show.
March 20-23—St. Louis Florists' Show.
March 29—Azalea Show.

APRIL

(Floral Display House)
Azaleas, Roses, Schizanthus.
(Outdoors)
Pansies, English Daisies, Early-flowering Shrubs.

MAY

(Floral Display House)
Hybrid Pelargoniums, Salpiglossis, Begonias, Marguerites, Lupines, and other spring annuals.
(Outdoors)
Bulbs (early in month), Hardy Water-lilies, Peonies.
Iris (late in month), Spring-flowering shrubs and perennials.

JUNE

(Outdoors)
Roses, Hollyhocks. Medicinal Garden.

JULY

(Outdoors)
Tropical plants. Annuals. Economic Garden — farm crops, fiber plants, rice, cotton, peanuts, tobacco, sugar-cane. Medicinal Garden.

AUGUST

(Outdoors)
Tropical Water-lilies, Victoria Cruziana, Lotus lilies. Economic Garden. Medicinal Garden.

SEPTEMBER

(Outdoors)
Tropical Water-lilies. Economic Garden. Medicinal Garden.

OCTOBER

(Floral Display House)
Dahlia (novelties and newer varieties).

NOVEMBER

(Floral Display House)
Chrysanthemum Show.

DECEMBER

(Floral Display House)
Poinsettias, Stevias.

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the board so constituted, exclusive of certain ex officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove ave nue and Flora place, on the Sarah car line (No. 42). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motorbus lines transfer.

STAFF
OF THE MISSOURI BOTANICAL GARDEN

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Trees and Shrubs

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Exotics

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Carpenter

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TROPICAL STATION, BALBOA, CANAL ZONE

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Manager

REPRESENTATIVE IN EUROPE

GURNEY WILSON, F. L. S.

Missouri Botanical Garden Bulletin

Vol. XVIII MARCH, 1930 No. 3

CONTENTS

	Page
The Pruning of Ornamental Trees and Shrubs	45
A Plant that Stopped Navigation	48
Frozen Hedges and Shrubs	51
Notes	53
Statistical Information	55
Floral Displays of Special Interest in 1930	

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1930

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OF THE MISSOURI BOTANICAL GARDEN

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EX-OFFICIO MEMBERS, IS SELF-PERPETUATING

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OLD VIBURNUM IN NEED OF RENEWAL PRUNING.

Shoots at "A" to be removed the first spring, those at "B" the following year.

Missouri Botanical
Garden Bulletin

Vol. XVIII MARCH, 1930 No. 3

THE PRUNING OF ORNAMENTAL TREES AND SHRUBS

The removal of any growth from a tree or shrub might be considered pruning; yet many distinct kinds may be recognized. Some pruning is adapted to shrubbery only, some to ornamental trees, still other kinds to fruit trees and bush fruits. Then there is topiary work in formal gardens and lastly "tree butchery." This article is concerned chiefly with the pruning of ornamental trees and shrubs.

Success in pruning will be proportional to the gardener's ability to co-operate with Nature. In every group planting the individuals are constantly struggling for light and food, and when the buds are shaded by their faster growing neighbors they cannot obtain light and food and consequently die. The same competition exists between the buds on the branches, and usually but one or two survive to continue the growth of a particular branch. A tree or shrub produces many more buds than can ever grow into mature branches. The majority remain undeveloped and grow only when an emergeney arises, but each single bud is capable of reproducing an entire plant if necessary. This "shading out" is Nature's way of pruning—a method which has produced the giants of our forests. Cultivated ornamentals cannot be permitted to follow such a method. The "specimen" tree or shrub on a lawn will have many lower branches nearly touching the ground. If planted in a group, it must accommodate itself to the limited space, and may not have one branch near the ground.

Before attempting to prune, allowance must be made for

this constant struggle. Consideration should be given to the age and vigor of the plant, the available moisture and food, the presence of buildings or other trees and shrubs which might shade it, and especially the pruning which it has already received. No hard and fast rule can be given for the pruning of any particular shrub because of the many varied conditions under which it will be found growing. For most shrubs a system of "renewal" pruning is all that is necessary. This consists of removing the older stems, those that are too old to bloom profusely (plate 10), leaving more room for younger and more vigorous shoots, which may with some shrubs begin to flower in two years. This method applies only to shrubs having the same flowering habit, as the mock-orange (Philadelphus), deutzia, nine-bark (Physocarpus), and dogwood (Cornus). All of these bear flowers on the older wood on short lateral branches formed the current year. Established plantings of bridal-wreath (Spiraea) and snow-ball (Viburnum) will require little or no pruning. Very old plants may be much improved by "renewal" pruning (plates 9-11) if it is extended over two or more years. *Hydrangea paniculata* and other shrubs which produce flowers on the new growth will require severe cutting back each year. Choke-cherry (Aronia), dwarf buckeye (Aesculus), and Kerria produce flowers on the tips of new wood, and require only the removal of dead wood. Lilac (Syringa) will not be killed by severe cutting back, but flowering will be much delayed. Basal shoots should not be permitted to grow unless the plant is on its own roots, and ordinarily little pruning is necessary.

Before pruning the flowering habits of the shrubs should be learned. A safe rule to follow is to prune within a short time after flowering, those which flower in early spring, that is before June. Those blooming later in the summer should be pruned in the fall. Never cut off the tips, for the flowers are produced there, but remove the entire shoot.

The proper pruning of shade trees presents a number of different problems. The flowers are usually inconspicuous, and only the continued growth and good health of the tree are important. The newly set tree has probably already undergone severe pruning to balance its loss of roots through transplanting. For the first few years training is necessary;

1
CUTTING SHOOT CLOSE TO GROUND.

2
REMOVING LAST LARGE OLD BRANCH.

3
COMPLETED.

RENEWAL PRUNING.

VIBURNUM BUSH BEFORE PRUNING

VIBURNUM BUSH AFTER PRUNING

if room to walk beneath it is desired the crown must be raised year after year until the desired height is reached. Then the permanent scaffold or lateral branches should be permitted to grow. These must be well spaced and equally placed around the tree. Before any training is attempted, a clear mental picture should be formed of the tree as it should look when mature. There are distinct types of branching, which are characteristic of certain trees. For instance, in the straight "single leader" type one branch continues all upward growth. This type is usually found in the pin oak, tulip, and sweetgum. The "modified leader" grows straight for a distance then turns off to a side, forming a flatter top, the Norway maple being an example. The "multi-leader," as found in most elms, ginkgo, and many other trees, has many upward-growing branches, sometimes all starting a few feet from the ground. These types must be considered when pruning, since an elm cannot be trained as a single leader nor will a pin oak achieve the same distinction if trained as a multi-leader type.

After the scaffold branches have been formed "corrective" pruning is necessary. This consists of the removal of one limb if two rub against or shade each other, the pruning of all dead and diseased wood, and, if the tree is to be grown as a single leader, of the immediate removal of any branch growing parallel with the leader. Removing the parallel branches prevents the formation of sharp "V" crotches which are generally undesirable. The exposed surface remaining after the pruning of any branch should be covered with a good white-lead paint, darkened with lamp black to make it less conspicuous, and repainted year after year until the cut has healed.

Most tree pruning is accomplished during the dormant season. This is partly due to custom, for "corrective" pruning can and should be extended throughout the growing season. Extensive cutting of larger limbs, sometimes properly called "tree butchery" can only be done while the tree is dormant. Pruning will not correct an over-crowded planting, nor keep large trees from growing larger. It is after all only an aid to Nature and not a cure-all.

Many special problems arise which are beyond the scope of this bulletin, and which only experience will help to solve.

Spraying, irrigation, fertilization, and cultivation are equally important, and only after these have been taken care of will the desired results from pruning be attained.

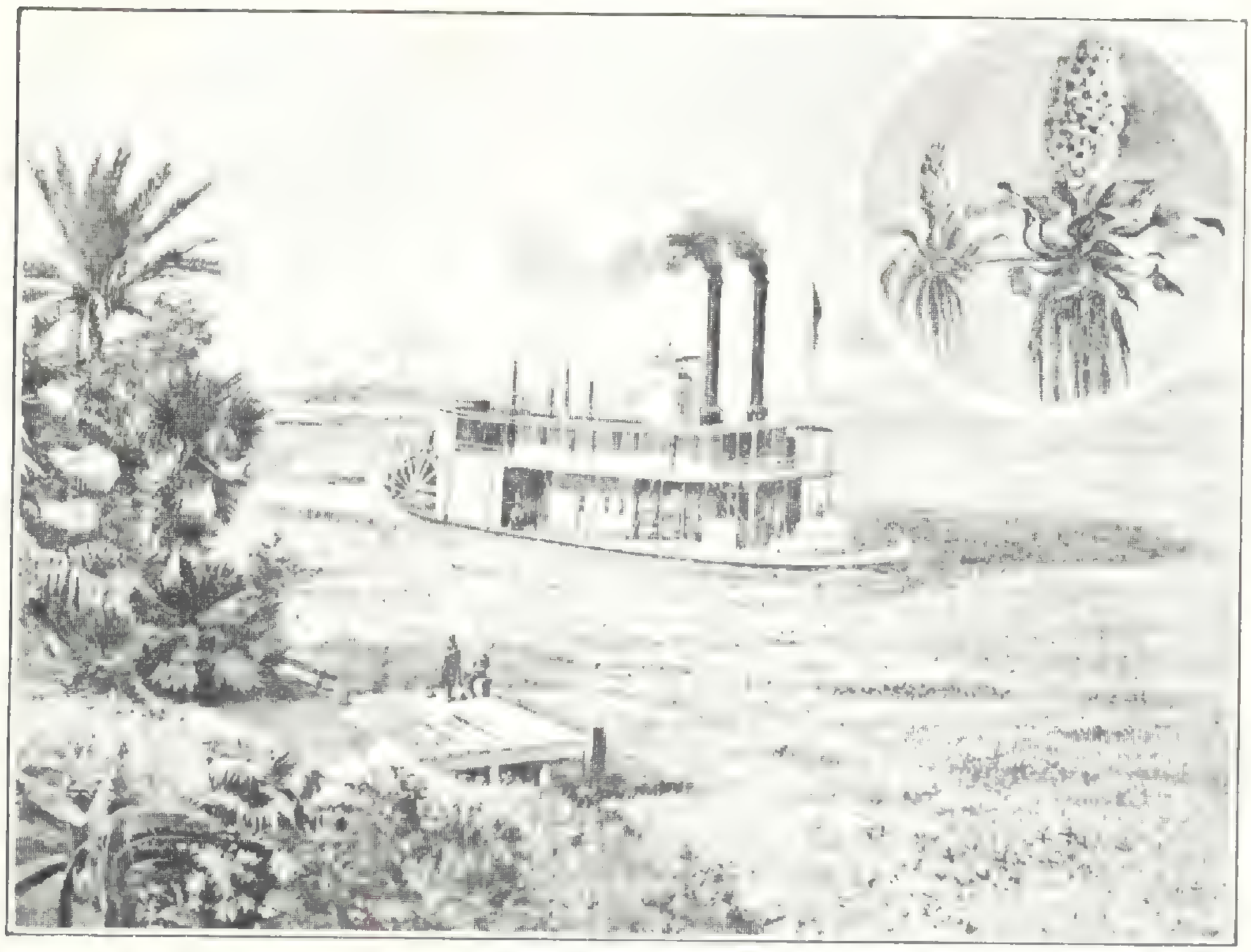
A. P. B.

A PLANT THAT STOPPED NAVIGATION

While it is a well-known fact that wild plants often multiply so rapidly as to render the land useless for any purpose until they have been eradicated, it is not so well known that certain water plants are likewise capable of emulating the familiar weed patch, making it necessary to expend much time and money in destroying them. In salt water the familiar "Sargasso Sea", with the fables concerning the trapping of vessels and their ultimate decay, furnishes an example of how marine plants, through the action of favorable currents, may accumulate in great masses and by a process of vegetable division perpetuate themselves. That the same thing may occur in fresh water is not so well known, and that the so-called "water hyacinth" *(Eichhornia speciosa)* with its attractive blue flowers could cause so much damage to navigation and commerce that the United States Government was compelled to take drastic measures to remove it seems scarcely to be credited. Yet here we have another example of a plant escaping from cultivation and becoming a serious pest.

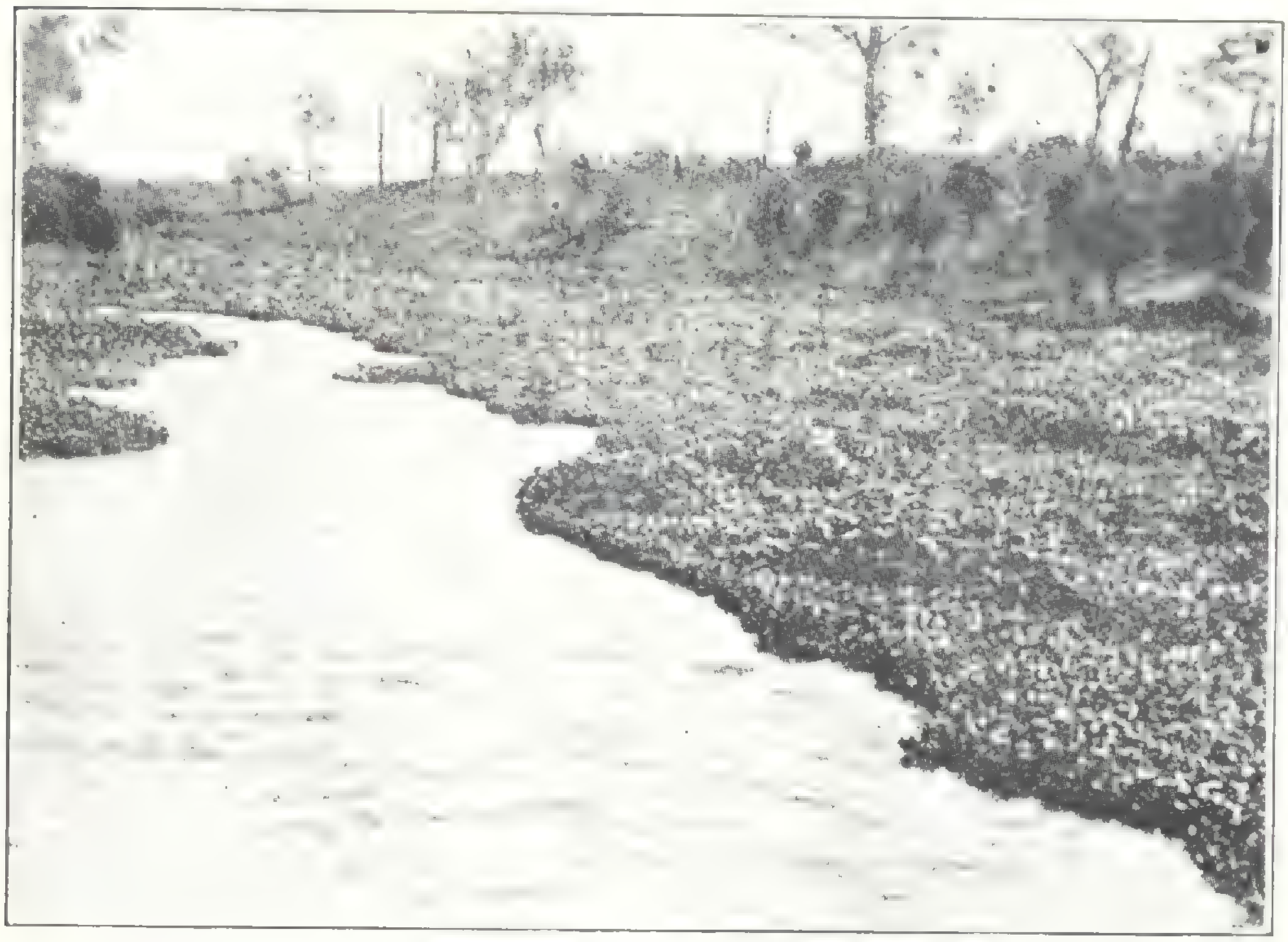
The water hyacinth was long cultivated in Florida as an ornamental plant, being used in pools both in greenhouses and outdoors. It appears that about 1890 a certain pond in the vicinity of Palatka, Florida, was cleaned out and the plants growing there thrown into the St. Johns River. Within five years a solid mass of water hyacinths entirely covered the surface of the river for nearly twenty-five miles, and steamboats caught in the entangled plants could make no progress (plate 12). This pest has been by no means confined to Florida. G. S. Jenman, Government Botanist in Georgetown (British Guiana), in an article published in "The Gardeners Chronicle" (1888), says:

"The water in the canals and trenches of the town and the estates varies from 2-5 feet in depth, and in the parts of the rivers that are occupied it is several feet deeper. But in disused trenches on



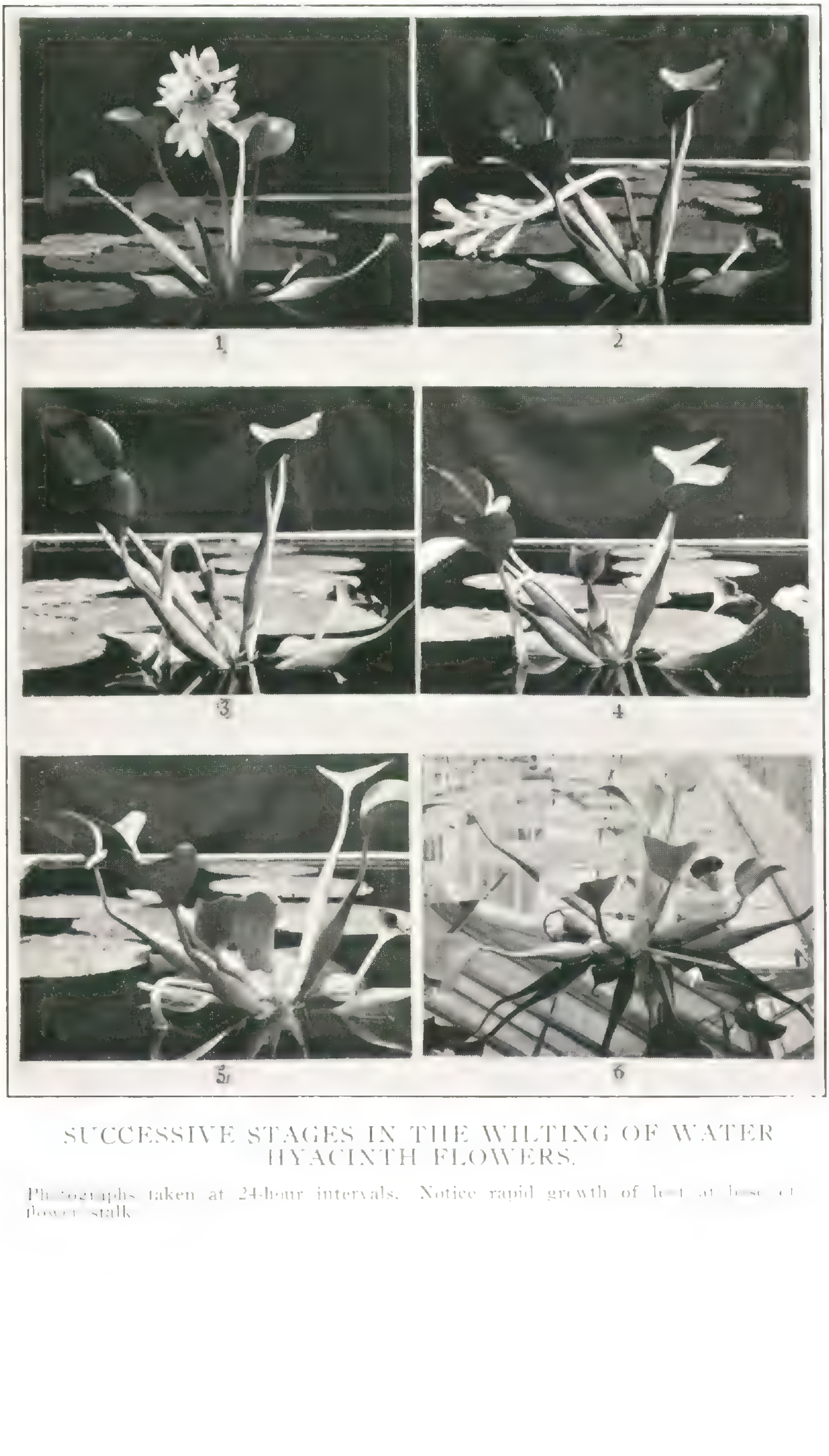
From "Harper's Weekly," March 19, 1908.

WATER HYACINTH IN ST. JOHNS RIVER, FLORIDA.



From "The Sydney Mail," March 16, 1901.

A YEAR'S GROWTH OF WATER HYACINTH IN THE RIVER BREMER, QUEENSLAND, AUSTRALIA.



SUCCESSIVE STAGES IN THE WILTING OF WATER HYACINTH FLOWERS.

Photographs taken at 24-hour intervals. Notice rapid growth of leaf at base of flower stalk.

the sugar estates, that are more or less silted up, plants are found in patches, or mixed with sedges and grass here and there, and in these trenches the roots penetrate the mud on which the plants rest. But by far the greater part of the vast abundance of *Eichhornia speciosa* found in the colony—and also that which is most luxuriant—is in deep water, where the roots cannot reach the ground. In such situations it is gregarious, and, like several of the other plants I have mentioned, is rarely, or very little, mixed with the other weeds, and forms glorious unbroken sheets, in its earlier stages of growth displaying a wealth of pale green foliage, and subsequently of delicate azure-blue bloom. On the Canje River large masses frequently break away from the main colonies that line the river, and, meeting together, block the entire width of the river, and greatly impede navigation. . . . "

And in another place he states:

"It is estimated that about 25,000 dollars are spent in this colony every year in keeping down this and other aquatic weeds in the canals and trenches; for so slight is the fall or gradient available, that a covering of weeds in the draining trenches almost entirely stops the flow, and in the navigation trenches, by which the cane are transported from fields to the manufactory, passage would be impossible if the Eichhornias were not cleared away."

Also T. A. F. Darker reported in 1901 that at Ipswich, Queensland, a single year's growth of water hyacinth in the River Bremer extended over an area three-quarters of a mile long and a half mile wide (plate 12). Naturally all navigation was stopped until the plants could be removed.

The reason for the rapid spread of this plant it is readily understood when its method of propagation is learned. It is the habit of Eichhornia to send out stems or stolons branching in every direction from the mother plant, and on the tips of these stolons new plants are formed. The connecting stolon may break or decay when the young plants grow independently. If, however, the stolons remain intact the parent plant may form the center of a colony of plants covering a considerable area, thus forming a solid mass on the surface of the water on which birds and even larger animals may make their way. The reason this mass does not sink with its own weight to the bottom is that in addition to its expanded surface the stems of the leaves are swollen into spherical or egg-shaped bladders which act as reservoirs for air, thus assisting the plant to float and also preventing its being turned over by the wind.

There are some five or six species belonging to the genus Eichhornia, one being native to Africa and the remainder to South America. While the common water hyacinth *(Eichhornia speciosa)*, seen at the Garden and in pools in parks in and about St. Louis, produces pale violet flowers, there are other varieties with rosy lilac and bright blue blossoms. In one species *(E. paniculata)* the bladders are not formed on the leaf stem, and this has been regarded as an indication that the water hyacinth was originally a land plant and has gradually adapted itself to life in the open water. Professor Boresch, of Prague, has been working on this theory for several years, and has experimented with *E. speciosa* to find out whether it could be adapted to life in soil. He has proved that the size of the bladders depends upon different factors, such as light, shade, temperature, and the consistency of the medium in which the plants were grown. In general, he found that the leaf stalks became elongated when the plants were kept shaded or exposed to higher temperature. When the plants were grown in pots in very moist soil, so that there was formed a widespread root-system which anchored them in the soil, the leaf stalks were stretched to such an extent that the bladders disappeared completely. If the plants be kept floating free on the surface of the water, or exposed to full daylight, or kept in lower temperature, large bladders are formed and the leaves become smaller. Between these two extremes there are various grades of transition which may be noted in the development of water hyacinth plants in the greenhouse. If a single plant be placed in a tank of water sixteen to twenty inches in depth and two to three feet in width, it is forced to keep itself floating on the surface, with the result that the bladders become large and the leaf blades smaller. As soon as young plants are formed, producing a coherent growth, the stability of this colony becomes greater and the individual plants are able to increase the size of the leaf blades. Finally, under favorable conditions during one season, the growth will have spread all over the surface of the water, the plants being so crowded that they form a solid mass (see plate 12). If the shape and size of the leaves be compared with those of the mother-plant when it was planted, it will be noticed that the stalks are more elongated, the blades

larger and the bladders more slender. Often only a slight swelling marks the place where under different conditions a large egg- or sphere-shaped bladder would appear. This experiment demonstrates the ability of the plant to respond quickly to different conditions, thus carrying on the "struggle for existence" more successfully.

Another phenomenon worth observing by those interested in plant life is the behavior of the flower stalks. As mentioned above, *E. speciosa* forms loose spikes with about eight blossoms. These blossoms last only for one day and wilt at or shortly after sunset. Plate 13, figs. 1-6, shows the successive stages in the wilting of the flower, the photographs being taken at 24-hour intervals. As soon as the inflorescence starts wilting the upper portion of the stalk with the fertilized blossoms begins to bend downward (fig. 2). When this upper part has reached the surface of the water, usually after five days, the lower portion of the flower stalk commences to bend at the base, thus pushing the developing seed-pods under the surface of the water (fig. 5). This movement stops when the lower part of the stalk is level with the surface (fig. 6). The upper part carrying the seed-pods is then submerged in the water at an angle of 45°, the seed-pods being covered and protected by the extended root system. If for some reason the equilibrium of the plant is disturbed during this period and the flower stalk stands out of the water, the bending continues until the lower part of the pedicel again is level with the surface of the water. This motility lasts only as long as the seeds are ripening. The whole process of bending requires from six to seven days.

R. V. L.

FROZEN HEDGES AND SHRUBS

The ever-popular California privet is widely used in and about St. Louis for planting around dwellings and for hedges. This privet makes an average growth of about two feet in a season, and in two years a hedge of the desired height may be obtained. Those who have had this kind of privet for only a few years are now much worried because they have

been told their hedge was frozen during the past winter. Consequently the Garden has been flooded with many inquiries and has been asked to state definitely what to do under the circumstances.

The last time the California privet was frozen to the ground was during the winter of 1923-1924, and the March, 1924, BULLETIN gave a detailed discussion on "Frozen Hedges and Roses and Their Treatment." In that article it was suggested that all California privet hedges be cut back to within a few inches of the ground.

The situation this year is practically the same as in 1924, and severe winters that will kill the privet hedges to the ground can be expected to recur from time to time. The fact that the California privet freezes to the ground in some years should not necessarily deter any one from planting it, if it is the plant best suited to his needs. It is reasonably priced, is easily obtained, makes a rapid growth, lends itself to shearing into any desired shape, and is adapted to many kinds of soil conditions. Cutting this hedge back close to the ground at this time of the year seems like harsh treatment, but it is the only way to regain a uniform stand. Some of the plants in the hedge are hardier than others, and it is a temptation to let such plants stand. This usually results in uneven growth of the hedge during the coming year and the final appearance is never satisfactory.

As suggested in the March, 1924, BULLETIN, there are other privets used as hedge plants that are perfectly hardy in this locality. Their growth, however, is coarser. The "Ibolium" privet, a cross between *Ligustrum ovalifolium* and *Ligustrum Ibota*, grows a little heavier than the California privet, but it is hardy. Those who become discouraged with California privet in winters like the past one are urged to try the Ibolium privet as it will prove hardy and will give practically the same effect as the California privet.

Certain early-blooming shrubs also suffered from the severe cold of the winter, notably the Forsythia. This shrub usually bursts forth in a mass of yellow some time in March, but this year a few scattered flowers may be found only where the drooping canes were covered with snow during the severest weather. The golden-bell (Forsythia) and the fragrant honey-

suckle *(Lonicera fragrantissima)* will not bloom this spring, but the damage to these shrubs is only confined to the flower buds. The leaf buds have not been damaged and the plants will continue growing as in previous years. Unlike the privet hedge, the entire plants have not been frozen and they will not have to be pruned to the ground as the hedge plants. Only such canes are removed as are normally cut away when the branches become too crowded. This subject is covered in the article on "Pruning" in this issue.

Most of the bush and climbing roses have been damaged by the cold winter, and all such plants must be cut back to the point where the new eyes are developing.

After such a severe winter as the one just past we find that those plants that are always over-anxious to grow with the first mild spell are also the first ones to suffer when bitter winter returns. The native plants growing in the same beds with those introduced from other climates have learned, through years of experience, that the first warm spell in the new year is not the beginning of spring and that more cold weather is still to follow. Consequently they are content to wait until their normal growing period arrives before venturing forth. The red-bud, fragrant sumac, and the other native shrubs and trees are now blooming or are preparing to bloom as they do in any other year, and they are able to do so because they have not been coaxed to flower by some of the mild spells during the past winter.

P. A. K.

NOTES

Dr. George T. Moore, Director of the Garden, showed moving pictures of plant life at Mary Institute, March 10, and at the John Burroughs School, March 12.

Recent visitors to the Garden include Dr. Edgar T. Wherry, of the Bureau of Chemistry, U. S. Department of Agriculture; Professors Alex Laurie and L. C. Chadwick, of the department of floriculture, Ohio State University, accompanied by their class in floriculture; and Mr. R. A. Studhalter, Head of the Department of Biology, Texas Technological College, Lubbock, Texas.

Dr. George T. Moore spoke before the St. Louis Co-operative Club, March 5, on "The Missouri Botanical Gardens"; and on March 6 he gave an illustrated talk to the Forsythe-West Lindell Improvement Association on "The Planting of Trees, Plants, and Flowers as a Community Asset."

Mr. George H. Pring, Superintendent of the Garden, gave the following lectures while he was in Panama recently: "The Missouri Botanical Garden and The Missouri Botanical Tropical Station," before the Woman's Club, at Cristobal, February 19; "Plant Curiosities," before the Army and Navy Y. M. C. A., Balboa, February 27; "Insect Pollination and Seed Dissemination," before the Balboa High School, February 26.

STATISTICAL INFORMATION FOR FEBRUARY, 1930

GARDEN ATTENDANCE:

Total number of visitors	19,954

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	46
Total number of books and pamphlets donated	233

PLANT ACCESSIONS:

Total number of packets of seed received in exchange	443

PLANT DISTRIBUTION:

Total number of plants distributed in exchange	30

HERBARIUM ACCESSIONS:

By Purchase—

Greene Herbarium, University of Notre Dame—Photographs of *Sidalcea*	4
Imler, Ralph H.—Plants of Kansas	430
United States National Museum, by Dr. Wm. R. Maxon—Plants of British Honduras, collected by C. L. Lundell	34
Weigel, Th. Oswald—Weese's "Eumycetes selecti exsiccati," Fasc. XV, Nos. 351-375, inclusive	25

By Gift—

Bush, B. F.—Plants of Hawaiian Islands, collected by Brother Matthias Newell	6
Mathias, Mildred E.—Plants of Missouri	2
Showalter, A. M.—Hepaticae of Missouri	2
United States Department of Agriculture, by E. B. Lambert and W. W. Diehl—*Pseudobalsamia microspora* from Minnesota	1

By Exchange—

Botanischer Garten und Botanisches Museum, Berlin Dahlem—Fragments of type specimen of *Musineum Ehrenbergii* Wolff	1
Botanical Institute, University of Brno, "Flora exsiccata Reipublicae Bohemicae Slovenicae," Cent. V, Nos. 401-500, inclusive	100
O'Neill, Rev. Hugh—Plants of Florida	62
Total	667

FLORAL DISPLAYS OF SPECIAL INTEREST IN 1930

In order that readers of the BULLETIN may have a more comprehensive idea of the various flower shows and outdoor exhibits which from month to month may be seen at the Garden, the following tentative schedule is given. While the indoor exhibits can be quite definitely indicated, the blooming period of outdoor plants is subject to variation, depending upon the weather, and out-of-town readers should confirm the date of any display before visiting the Garden.

JANUARY

(Floral Display House)
Orchids, Primroses, and Cyclamen.

FEBRUARY

(Floral Display House)
First half month—Orchids.
Second half month—Cinerarias.

MARCH

(Floral Display House)
March 1-17—Bulb Show.
March 20-23—St. Louis Florists' Show.
March 29—Azalea Show.

APRIL

(Floral Display House)
Azaleas, Roses, Schizanthus.
(Outdoors)
Pansies, English Daisies, Early-flowering Shrubs.

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Hybrid Pelargoniums, Salpiglossis, Begonias, Marguerites, Lupines, and other spring annuals.
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Tropical Water-lilies, Victoria Cruziana, Lotus lilies. Economic Garden. Medicinal Garden.

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Poinsettias, Stevias.

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove avenue and Flora place, on the Sarah car line (No. 42). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motorbus lines transfer.

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Missouri Botanical Garden Bulletin

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CONTENTS

	Page
The Missouri Botanical Garden and the St. Louis Schools	57
Records of First Blooming of Wild Flowers in the Vicinity of St. Louis	82
Notes	84
Statistical Information	85

Floral Displays of Special Interest in 1930

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THE MISSOURI BOTANICAL GARDEN AND THE ST. LOUIS SCHOOLS

The modern botanical garden fails to serve the community to the fullest degree if the school child as well as the advanced student cannot learn from it and be interested in it. Educators seeking improved methods of teaching are beginning to recognize the fact that a garden such as the Missouri Botanical Garden furnishes some most important and unique opportunities for imparting knowledge. Formerly books and travel were the chief sources of information to the grown-up, as well as those younger, but in these days of the moving picture visual education is taking a larger and larger place.

Exhibits of plants native to a tropical country being studied at school may give the pupil a better idea of conditions in that country than anything else short of an actual visit. The knowledge of the way tropical fruits, spices, and perfume plants look and grow, the lessons derived from the cultivation of coffee, tea, rice, sugar-cane, cotton, peanuts and a host of other useful plants, cannot but be a most helpful adjunct to any child's education.

Nowhere can the fundamental facts concerning heredity, selection and breeding be so satisfactorily demonstrated as in a garden. Even an insight into physiology, morphology, and pathology may be imparted to a child through a study of the life of a plant. Most children are interested in gardens of one sort or another, and through their desire to know

about plants many important bits of knowledge are almost unconsciously acquired. A botanical garden, aside from its many other functions, should be regarded as an educational institution, and its use by the schools of a city fortunate enough to have a public garden should be encouraged in every way possible.

While the facilities of the Garden have always been available to the pupils and teachers of the St. Louis schools, there has never been any particular effort made to systematize the work. For years it has not been an uncommon sight to see a teacher with her class going through the Garden, and small groups of boys and girls have always been granted permission to gather leaves of trees and other specimens for school use. But with the increasing interest of the school children in the things that can be learned at the Garden, a time would seem to have come when the facilities available could be better organized, particularly as regards letting it be known just what can be done.

At the request of Mr. C. G. Rathman, Adviser in Visual Education for the St. Louis Public Schools, the Director met with a number of the school principals and after a walk through the Garden discussed with them the possibility of making the institution more useful to children of school age. The general opinion seemed to be that teachers would be glad to take advantage of the opportunities offered if they knew what they were and how to use them. Consequently, there has been prepared a series of suggestions which will at least furnish a basis for developing ultimately a somewhat comprehensive series of studies that can be profitably carried on at the Garden. It is not the intention to teach botany or horticulture, but simply to furnish the teachers with certain information which will enable them to supplement by actual observation certain aspects of the regular class-room work. Talks to the children will not be given by members of the Garden staff — that will be done by the school-teacher. Should there be sufficient demand, however, arrangements can be made for groups of teachers to hear a discussion by a member of the Garden staff on some particular subject; they in turn imparting to the pupil as much of this information as is necessary or desirable. It is hoped that the number of

children visiting the Garden with one teacher will not be so great as to defeat the object of the new arrangement—namely, to make it a dignified school exercise, pleasant, but distinctly informational rather than recreational.

It should be understood that the topics listed below are merely suggestions, and are capable of almost unlimited expansion. Furthermore, the wealth of plant material available makes it possible to illustrate almost any aspect of the vegetable kingdom which will supplement the regular school exercises.

THE COFFEE AND BANANA HOUSE

The coffee and banana house was designed and planted to resemble the coffee and banana plantation, or "finca", in tropical America. A narrow path curves through the "finca", with interspersed banana trees and coffee bushes. Occasionally other trees and bushes typical of tropical climates are to be seen, and in the background tropical vines, called "lianas", bearing whole bouquets of brilliant artificial-looking flowers, add the vivid splotches of color always associated with tropical vegetation. One almost feels as though it would not be too surprising to be met by a mozo, or native plantation worker, around the next clump of bushes. The air is balmy and sweet with the odor of the lush vegetation and the sound of a water course is heard from a distance.

Coffee.—The coffee bush is thought to have grown originally in the hills of Abyssinia, the Sudan, and the island of Mozambique. It is known that it was used as a drink in Ethiopia from the earliest times. From Ethiopia the use of coffee spread to Abyssinia, and from thence to Arabia. It was Arabian coffee, shipped from the port of Mocha, that resulted in the high esteem for, and the general use of the term, "Mocha" for millions of tons of foreign-grown coffee.

The introduction of coffee as a beverage into Europe dates back to about the middle of the seventeenth century, and immediately it became a universal favorite. Coffee-houses soon became numerous and served as congenial gathering-places for literary men, politicians, and all other ranks of society. The coffee-house was one of the forerunners of the

modern "saloon", and was as roundly denounced by moralists of that period.

Louis XIV, king of France, is credited with having introduced the plantation of coffee into the French West Indies. In the eighteenth century the culture was brought to Brazil. Mexico, Sumatra, Java, and the Philippine Islands were next among the commercial cultivators. Africa, the home and only important source of coffee until 1800, is now a relatively unimportant factor in its production, while Brazil has become the world's leader. It has been estimated that the world consumption of coffee is now between 2,500,000,000 and 3,000,000,000 pounds annually. The United States is apparently the largest single consumer. The average annual consumption per person is about twelve pounds.

The coffee plant forms a fairly symmetrical bush which bears frequently throughout the year many rather small whitish flowers, these in time replaced by a crop of red berries about the size of a small marble. In Arabia the berries are boiled whole, and a liquid rather more resembling tea than our familiar beverage is obtained. In other countries only the seeds of the berry, called the coffee "beans", are used. Ordinarily a mill is used to remove the pulp while fresh. In many American plantations, however, the fresh berries are placed at once in large vats of water where they ferment and the pulp separates from the beans. The beans are then cleaned by machinery and dried for three to four days by spreading out in a thin layer over a stone floor, being stirred occasionally to accelerate the drying process.

The coffee is then stored until perfectly dry, when it is again spread out in the sun for two or three days. When the beans are too hard to be broken easily with the teeth, they are hulled in a mill propelled by hand, by mule, or by water, and the resulting debris blown away by a winnower. At last the beans are packed in bags and sent to the roaster. After roasting, the beans are ready for the market.

Bananas.—For a fruit with as many practical associations, it may be surprising when one is told for the first time the romantic history of the humble banana. Migrating races have carried it with them to their new home as a most priceless

possession; upon the price of a bunch of bananas governments have risen and fallen.

The first home of the edible banana is thought to have been in the humid tropical region of southern Asia, which is known to anthropologists as the "home of the human race." As the teeming Asiatic peoples migrated to the islands of the Pacific Ocean (which is thought to have been at about the time of Christ), bananas were carried along with the other agricultural necessities. The earliest white explorers found bananas cultivated in Hawaii, and in Easter Island, a small island in the south Pacific between South America and Australia, and 2,000 miles from the nearest human habitation. The banana was one of the first foods of man, and it was probably one of the first cultivated plants. The absence of seeds in the banana has long been considered evidence of very early cultivation.

The Portuguese discoverers brought the cultivation of the banana from India and Egypt to the Canary Islands about the year 1402. From the Canary Islands it was in turn introduced into the island of Santo Domingo, in the West Indies, by the Spanish monk Father Tomás de Berlanga, afterward Bishop of Panama. Immediately upon its introduction to tropical America, the banana became a most highly prized food, and a staple due to its easy propagation. However, it was impossible to import it to the northern ports because it was so delicate that it could not withstand the long voyage successfully. The first bananas were shipped to New York from Cuba in 1804, and the fruit was looked upon as a great curiosity. By 1850 clipper schooners were bringing occasional small cargoes from Cuba. Toward the close of the Civil War small lots of bananas found their way to New Orleans in schooners from the Bay Islands, off the coast of Honduras, and were sold at auction upon the levees.

At the present day the fruit companies which ship bananas to the world's ports are the powers behind the thrones in most tropical American countries. The governments dare not displease the banana shippers, who hold the fate of the population in their hands. A certain Central-American republic at the present time faces the dire result of having raised the tax upon bananas from three to five cents per bunch. In

such lands the banana is king and exacts a royal tribute. The United States and Canada are the world's largest market for bananas. Their total consumption for 1926 was 53,500,000 bunches exported from the Caribbean countries, and 250,000 bunches from Hawaii.

The scientific name of the banana, Musa, comes from the Arabic word "muz". The Hindu worshipers of the goddess Kali worshiped it upon the third day of the month, called Sravana. The West African word for the fruit, "banema", or "bonano", is considered to be the source of the popular name. The banana plant is most frequently spoken of as a tree, but such is not the case. The banana is very similar to the canna plants used so extensively for cultivation, to which it is in fact closely related. As any one can easily see, the banana plant is not woody, and planks could scarcely be hewn from its juicy stem. Therefore the plant is not a tree, but an herb—one of the largest in the world.

THE DESERT HOUSE

The old proverb "Birds of a feather flock together" should be framed and hung over the entrance to the desert house. How can any one who isn't a trained botanist walk through the house and pick out the real cactuses from the milk-weeds and spurges and night-blooming cereuses and stone-crops which merely look like cactuses? As one looks at these plants one wonders which of them was the first to discover how to keep from being thirsty in the desert. By this time they all know the secret, however, and they have all been wise enough, with Mother Nature's help (perhaps all the credit belongs to Her), to take advantage of it. The enormous barrel-cactus upon the south side of the path looks formidable and very wicked with all its bayonet-like needles and fortress construction, but within all is sweet and juicy pulp, thanks to the water artfully drawn from the seemingly parched sand and protected from evaporation by the thick rind. The water stored within the trunks of such cacti has saved the lives of many travelers in American deserts.

The desert house is a fairly successful attempt to represent desert plants in the natural condition under

which they grow. Few of the great deserts of the world are the barren, desolate wastes of our imagination. By far the greater portion of them, like our own Arizona deserts, are more or less clothed with natural vegetation. More than one visitor has commented on the garden-like effect of natural desert scenery. "Try as you will to get rid of it, the garden idea sticks in your mind," writes one visitor to Arizona, "and the more you see of these deserts, the more fixed does it become. Many times your progress will lead you to a five or ten-acre tract of desert botanical garden, whereon you will find that Nature had joyously thrown together a fine sample of all the species that have been used in planting operations for twenty miles around. When we begin to analyze the component parts of the desert, we immediately notice that it is made like an old-fashioned museum. Each object is an individual specimen, standing on its own solitary pedestal. Each is a perfect botanical specimen, growing in its own invisible tub, standing alone, and quite untrammeled by its neighbors. Out of a million desert plants nearly every one has its own circumpolar area of smooth bare earth. Elsewhere we have been accustomed to seeing bushes massed together with little individuality; and the independent specimens of the desert are far more interesting. They compel interest in a way that massed bushes never can, no matter what they are. Out here every traveller becomes a botanist, because the facilities are matchless and the temptation is irresistible. The reason for the zones of bare ground between the bushes is easily recognized; there is not enough water to support a shrub growth that is continuous. The desert rain is sufficient only for one bush every five or ten feet; not to be wondered at in a region where the average able-bodied man consumes two gallons or more of drinking water daily."

If portions of a desert often look like a botanical garden, is it too much to claim that a portion of the Missouri Botanical Garden resembles a real desert? The essentially natural aspect of the planting in the desert house becomes even more remarkable when we consider that the plants have been brought, not from any one region, but from all the great deserts of the world. Some, like the prickly pears, are

from our own western deserts, and some, the stapelias, for instance, are from South Africa. Others are from northern Africa, Asia Minor, and Australia. That they fit so naturally together is due to the fact that most desert plants have many features in common, while some of them are almost identical in general aspect. When we come to study them we find them adapted for desert life in two general ways. First, they are adapted for water-storage; second, they are well protected by various kinds of spines and thorny outgrowths. Water storage is effected by some sort of a reservoir and by various devices for reducing evaporation, such as a waxy coating over the skin, accordion plaits which shrink together during dry weather and reduce the amount of surface exposed to the desert air, etc. Scientists themselves are not agreed as to how desert plants developed the features we have been considering: thick, waxy skins, protective thorns, water reservoirs, etc. Whether they were developed in response to the desert environment; whether plants with features of this sort, having originated elsewhere, spread to the deserts and found there a favorable home; or whether we rely upon some other explanation, are questions that must be left to the future. Of only one thing are we certain: we find desert plants adapted to desert life.

THE GRAFTED CACTI

Those queer, misshapen objects on display in the alcove of the south entrance to the main greenhouse are cacti surely, but they look more like the product of a child's imagination than objects of nature. With the use of various cacti, night-blooming cereuses, and spurges which we have already seen in the desert house, the gardeners have played building-blocks. Just as a fruit-grower grafts his fruit trees, so the cactus-grower has grafted one peculiar-looking vegetable building-block upon another.

One can graft one sort of apple upon another sort of apple tree, but one cannot graft a mulberry tree upon an apple tree. Likewise, a night-blooming cereus can be grafted upon a cactus, or *vice-versa*, for the cereus is really only another kind of cactus. The spurge, however, can only be grafted upon

a spurge, for it has milky juice while the cactus has clear juice, and neither one can bring itself to adopt the other's point of view.

ECONOMIC HOUSE

As one may well believe after visiting it, the house containing the tropical fruits and spices is one of the most interesting in the whole garden. In this house, unlike the specialized houses, a great number of miscellaneous plants are gathered together, representing the sources of many of the familiar perfumes, spices, fruits, and drugs. The diverse nature of the contents of this particular house may be appreciated from the following notes upon only a very small percentage of the plants.

The chewing-gum tree; Sapodilla plum (Achras Sapota).—This tree resembles the persimmon and belongs to the same family. It is a native of tropical America, but is generally cultivated in the warmer spots of the whole world. The fruit tastes like a superior sort of persimmon, looks a little like a small round Irish potato, and has caused some people to pronounce it the very best-tasting fruit in the world. However, if this were true it would probably be more widely used. As it is, the tree is cultivated almost entirely for the bark, which is full of a white, rubbery sort of juice used in the making of chewing-gum. Chewing-gums can have many different sorts of flavor, but they all have to have some sort of elastic snap to make them "chewy," and the juice from the bark supplies this principle. The Indian name for the plant is "chicle."

The ginger plant (Zingiber officinale).—This weedy-looking little plant is a very important crop indeed in the warmer parts of Asia, Africa, and the West Indies. The root-like stems, or rhizomes, yield the well-known spice, ginger. The underground stems are very fleshy and full of the spicy juice which is preserved in the tissues. At certain times of the year they are dug by the natives and dried on tables placed in the hot tropical sunshine. Preserved ginger is merely the young shoots of the rhizome boiled for a long while in a sugary syrup. The boiling reduces the peppery taste of the fresh plant, which is almost too strong to endure.

In preparing the ginger for preserves it is necessary to protect the hands with gloves, or they will "burn" for days.

The tiger-apple or ordeal plant (Cerbera Tanghin).—This plant has had a dark past in the superstitious rites of African tribes. Among the bushmen of Africa the eating of the fruit is used as a test of divine judgment against an accused person. If the prisoner can eat the apple successfully, he is acquitted. As a matter of fact, however, even the kernel of the fruit contains enough deadly poison to kill twenty people, so that the verdict is usually "guilty." Other plants of the same family are equally poisonous, and their juices are used by the natives to poison their arrows and spears. The poison so effectively used by the natives in their warfare against the invading white men was a great mystery until the venomous plants were discovered, and then means could be taken to counteract it.

Black pepper (Piper nigrum).—The black pepper plant is half vine and half shrub. It scrambles over whole plantations in India, Malaya, and elsewhere in the tropics. When the use of pepper as a seasoning was first introduced into Europe several hundreds of years ago the people went wild over the improvement which it made in even the most commonplace food. Every one had to have pepper in his food, and because of that demand many sailors set out to procure the coveted condiment. The quickest and best way to India and the Spice Islands, as Malaya was known in the early days, was the ambition of half the nations in Europe. Upon one of the expeditions to find a shorter route, the Cape of Good Hope was discovered; upon another, the continent of America. When Alaric the Goth captured Rome he demanded as his tribute 5,000 pounds of gold, 2,000 pounds of silver, and 2,000 pounds of pepper. In medieval England rents were sometimes paid in pepper.

The pepper-vine bears many minute flowers, or florets, which are in turn replaced by many little berries. "Black pepper" for the table consists of the dried unripe berries ground whole. "White pepper" is the ground seeds from which the skin and pulp have been separated, and consequently commands a somewhat higher price as a rule. Un-

fortunately, although the pepper-vine has been introduced into California, it does not produce seed.

Dumb-cane; mother-in-law plant (Dieffenbachia Seguine).—The caney-looking "mother-in-law plant" is a frequent object of interest in greenhouses. As it is very easily propagated by cuttings of the stem and not difficult to grow, it is frequently obtainable at florists at a reasonable price. Many people have asked just why it is called "dumb-cane" and "mother-in-law plant." The reason for both is that the tissue of the stem is packed with tiny crystals which are exceedingly irritating to the skin, and especially the membrane of the mouth. A gardener who has been making cuttings of the plant and inadvertently touches his fingers to his mouth will shortly after experience most painful burning sensations wherever the juice of the plant has touched. Those who chew it sometimes lose the power of speech for several days. A safe rule is never to chew a plant about which one knows nothing. However, the early Spanish rulers of tropical America, where the plant is native, knowing its painful effects (perhaps from sad experience), frequently inflicted the chewing of it as a torture upon slaves suspected of lying; hence the name "dumb-cane."

THE PALM HOUSE

Visitors to the Garden who have seen real jungles are always loud in praise of the palm house. The arrangement of the plants to simulate a small patch of tropical woodland could hardly be improved and still serve the purpose of a botanical collection. The size of many of the specimens is particularly noteworthy. The palm house appears to merit the distinction of being the most popular house in the whole Garden. There are so very many interesting plants in this house that it seems unfair to mention only a few:

Date palm (Phoenix dactylifera).—Several fine specimens of the date palm are to be found here. They are the largest and most picturesque specimens in the entire collection. One of them, bending over the east walk, has become so top-heavy that a large chain has been fastened to it to keep it from obstructing the path.

The date-palm is a tree averaging from forty to fifty feet in height. It is distributed over southern Europe, northern Africa, and southeastern Asia. As was the case of the coffee bush, the Arabs were largely instrumental in the spread of date-palm cultivation. The tree is invaluable to the desert tribes of north Africa and the Sahara Desert whose most important wants it supplies. The fruit serves as the most common food not only for the natives but also for their live stock. The huts and houses are chiefly constructed from the scanty wood of the tree.

The culture of the date-palm runs far into the earliest antiquity. It was long the emblem of the Jewish people, Jericho being known as the city of palm trees. Date-palms have recently been introduced into our own desert region of the Southwest, and in time native fruit may supplant that now imported in such large quantity from northern Africa and Arabia.

The Panama-hat palm (Carludovica palmata).—Although it is only a small palm with scarcely any trunk, the Panama-hat palm has a great appeal to the people who visit the palm house, especially in warm weather. In Panama the leaves of the palm, which are about all there is to see of the plant, are gathered when very young and cut into narrow strips which are then soaked successively in boiling water, in water acidulated with lemon juice, and finally in cold water, and allowed to dry. When the soaking and bleaching are completed, the strips are made into ribbons and woven into hats. The industry of Panama-hat-making is a very prosperous and influential one, although it is chiefly handled by numerous individual concerns rather than by one monstrous trust, as are the bananas.

Giant bamboo (Bambusa arundinacea).—With the exception of the date palm, perhaps the clumps of bamboo at either side of the north entrance to the palm house may be considered the most picturesque component of the collection. Just like the pictures in our old geography books, the giant grass-like stems rise gracefully to a height of twenty to thirty feet. The narrow-leaved foliage resembles that of the willow—a misleading clue to their relationship, for the bamboo is a grass, although the largest one on earth. The people

of southern Asia, where the bamboo grows naturally, are very fond of it as a garden plant, and it appears in many of the Japanese and Chinese works of art, from chinaware to Mandarin coats. Besides serving as an inspiration for *objets d'art*, the stalk of the bamboo is used in weaving, basketry, house-building, and fishing-poles.

THE FERN HOUSE

All of the other houses which have been discussed have been found to contain plants of economic importance, or else of some freak design in construction and function. They teach lessons of every-day life. Not so the fern house, which, aside from certain scientific interests, exists merely because it is pretty and because people like cool, green, fern-bordered paths, and the sound of water splashing into a little pool.

The fern house also teaches a lesson, but it is a lesson not of every-day life but of a time which no man can remember, for there were no men then. In a piece of ordinary furnace coal, if one is sufficiently keen-sighted, tiny bits of fern leaves and stems may be seen. For coal, the scientists tell us, is the leaf-mold and muck of swamps which existed so long ago that a difference of a million or two years is of no consequence when we try to say just how long ago it really was. However, we do know that at that time ferns and fern-like plants were the most characteristic vegetation upon the earth and that none of the plants with which we are now familiar even existed. But now, the ferns are not common except in places which happen to suit their fancies particularly well, and other plants, young upstarts of less old and respected families but with the modern method of living, are not only taking their place but crowding them out altogether. The ferns have not kept abreast of the time and so they are being displaced. Who can imagine what sort of plants will eventually take the place of the ones which have the upper hand now? The only economic use of the fern-like plants, of any consequence, is in the manufacture of funeral-wreaths from the palm-like leaves of the cycads. What could be more appropriate?

THE ECONOMIC GARDEN

To those relatively few visitors to the Garden who penetrate beyond the main greenhouses and their surrounding lawns, the economic garden holds much interest. This part of the Garden makes no attempt to imitate Nature; it is merely a collection of little plots containing samples of some of the world's most famous and interesting crops. Let us examine a few of these crops and try to find some of the reasons why they were selected for a place in the economic garden.

Wheat.—There is little need to discuss the importance of wheat, especially to a white man. A Chinaman could easily do without wheat, but it is the white man's favorite food. During the World War the greatest sacrifice which many stay-at-homes made was the giving up of white bread. No form of rye, barley, corn, or any other bread would satisfy.

Next to rice, wheat is the world's greatest food. Unlike the former, however, it is one of the most easily adaptable of plants. It will grow in almost any kind of soil and in almost any temperate climate. So important is the power of wheat that the nation which is able to produce the most and the best wheat is able to hold the balance of power of the world. To hold the power that lies in wheat a nation must have large areas for its growth, and deep, rich soil. Russia, Argentina, Canada, and the United States are the greatest wheat-growers of our day.

However, wheat cannot be grown continuously on the same land. It withdraws so much nourishment from the soil that eventually little is left for the nutrition of future crops. It is said that this is what brought about the downfall of Rome, for civilizations must have access to abundant food supplies. The effect of continuous crops of wheat upon the soil is the same as that of continuous plantings of any other crop. For the plant withdraws always certain substances from the ground, and when these are gone the plant naturally suffers. To counterbalance this result of cultivation, farmers have learned not to grow the same things in the same soil every year, but to alternate, say, a crop of corn with a crop of wheat. This plan is known as the "rotation of crops."

Rice.—Rice is believed to be the world's greatest crop. It is estimated that the production of the grain in 1929 was over 440,000,000,000 pounds. It is probably the staple food for the greatest number of people.

Rice cultivation began in the period before history. Because the earliest history of rice is in Chinese, many people believe that its origin was China, which is probably true. In the old Chinese language, a single word means both "rice culture" and agriculture in general. Unlike wheat, rice is a plant of warm climates, and is unable to grow at low temperatures. Alone among the world's great crops, it grows typically in a field of standing water. Asiatic peoples living in mountainous regions have invented many clever ways to obtain standing water for their rice. In the interior of China or in the hilly regions of Japan or the Philippine Islands, the sides of the hills are graded into broad flat terraces with confining rims. Thus, when it rains, little pools are formed systematically laid out, in which the water-loving plant is able to grow, sometimes at elevations of a thousand feet above the surrounding country-side.

Japan is the most industrious rice-growing country. In 1929, more than 7,800,000 acres were given over to the culture of rice, representing more than one half the extent of cultivated land in the kingdom. In the United States, people are inclined to treat rice as a vegetable instead of a grain, and its cultivation on a large scale is comparatively recent. Its popularity, nevertheless, is growing by leaps and bounds. In 1929, 881,000 acres were given over to the cultivation of rice in the United States, yielding a total of 35,000,000 bushels of grain.

Cotton.—Next to food, man's chief dependence upon plants is as a source of fiber from which clothing may be made. Cotton is the most important of all fibers. Its cultivation gives employment to millions, and its preparation into cloth is the means of livelihood to many millions more. The world's output of cotton in 1929 was over 11,000,000,000 pounds of fiber. Of that total, the United States alone produced about 7,000,000,000 pounds.

Cotton is a rather small plant belonging to the hollyhock family, and producing small flowers resembling a yellow

hollyhock. At first it is a very commonplace and uninteresting vegetable, but when the seed-pods are mature and open, fleecy white cotton is to be seen tightly stuffed within. In looking at the snowy handful of cotton which each seed-pod contains when mature, one is apt to overlook the fact that there are seeds within the pod, as well as cotton. The so-called "plant wizards" have never been able to produce a seedless cotton-plant, and it is exceedingly doubtful if they ever will, for the cotton fiber is nothing less than long white hairs growing out of the seed itself. If there were no seeds there would be no cotton fiber. Besides producing the fiber, however, the cotton seed also contains a great deal of oil which is pressed from it by enormous hydraulic machines and used as ingredients of salad-oils, butter substitutes, etc.

Cotton was first brought to the attention of Europe through tales brought back by travelers to Egypt and India, long before the time of Christ. The soldiers of Alexander the Great thought the fiber was wool growing on a bush, and gave rise to the story that a lamb, half plant, half animal, inhabited Asia. This useful combination, with its hooves rooted in the ground, browsed eternally on the herbage about it and kindly allowed the Hindus to cut the wool from its back.

Although mythically known from a very early period, cotton cloth was not common in England until the fourteenth century. However, species of cotton were being cultivated in America, all unknown to the inhabitants of the Old World. When Cortez came to the capital city of the Aztecs in Mexico he was amazed to find the people dressed in cotton robes. It was not until the close of the colonial period that cotton was grown in the United States. The soil and climate of the southern states proved so ideal for its cultivation that a great boom was given it. It is well known that slavery was on the wane in the South until cotton became king. Then, however, as the demand for cultivation grew the practice of bound employment so increased that it precipitated a conflict in the middle of the nineteenth century which might have disrupted not only the power of the United States of America but the Anglo-Saxon race.

Corn.—Corn is the only important food which America has given to the world. When the earliest discoverers came to the New World they found the principal staple of food to be a grain which the natives called "maize" and which they held in a form of religious veneration. In Longfellow's poem "Hiawatha" the story is told of the coming of the maize to the Indian tribes and how it insured against famine and pestilence in time of need.

In the Americas corn is still one of the most important crops, and is grown principally in the great fertile prairies and river bottoms of the West and Middle West. In 1929 the total corn crop amounted to about 2,500,000,000 bushels. In the Old World corn is also an important crop, but is used chiefly as a food for cattle.

Corn is one of the most adaptable plants to cultivation, and at the time of the discovery of America was common property of practically all the Indian tribes of both North and South America. It is also the most majestic of all grain plants, attaining a height of fifteen to twenty feet in fertile, well-watered soil, such as that of the flood-plains of the Mississippi and Missouri rivers.

Tobacco.—Tobacco is perhaps the most famous crop which has originated in America. Columbus was the first white man who ever saw tobacco. At the time of his first visit to America, it was grown and smoked from southern Canada to Patagonia. It was ever a means of barter among the tribes, and among those who were unable to cultivate it for themselves it was a priceless luxury. To the Indians the tobacco was a sacred plant, and its smoke was equivalent to incense.

It is said that Sir Walter Raleigh was the first man to introduce the use of tobacco to Europe, but it is another Englishman, Sir John Hawkins (1565), who deserves the honor. Sir Francis Drake is credited with starting the custom of tobacco smoking in 1573, and it is from that year that its popularity dates.

The tobacco habit gained foothold in Asia sooner than it did in Europe, and did not historical records prove otherwise we might believe that its use originated in Asia. The various methods of smoking tobacco all hark back to its use

by the American aborigines. The cigar is the national smoke of the West Indies (especially Cuba) and South America. The cigarette was first used in Mexico and Central America, while the pipe was the invention of the Indians inhabiting the region of the eastern United States. The English conquerors of the Indians of the United States consequently spread the use of the pipe to Europe, while the Spanish, the conquerors of the tropical and subtropical tribes, are responsible for the popularization of the cigar and cigarette. The other uses of tobacco were originated by Europeans. The least lovely of the various tobacco habits, chewing, was inaugurated by the pioneers of the English North American colonies. This practice supposedly arose as a prophylactic during the great plague of 1665, for it was believed that the plague never descended upon a tobacco shop, and school boys were instructed to chew the quid as a preventive. Snuff-taking started in France and Spain. It is said that the first person to use snuff was Catherine de Medici, who professed to be cured of colds and headaches by placing a little tobacco powder up her nostrils.

THE MEDICINAL PLANT GARDEN

Directly behind the pergola of the Italian garden is the medicinal plant garden. For most people, the chief charm of this portion of the Garden undoubtedly lies in the beautiful spreading shade-trees, the quiet paths, the ponds, and meandering streams. Quite apart from its natural beauty, however, the medicinal garden serves much the same purpose as the economic garden. It is a sample collection of many of the world's important drug and medicine plants. Drug plants, it appears, are much more attractive than economic plants, and the casual visitor may think that he is in a purely decorative garden when he sees the beds of stately fox-gloves, or in a wild garden, at the sight of wake-robins and blood-root flowers clustered as though growing naturally beneath the trunks of spreading trees or shrubs. As a matter of fact, many of the so-called decorative plants were originally cultivated because they were believed to have value in medicines, and they have escaped, as it were, from the medicinal

garden into the decorative garden. Originally, however, all plants, economic and medicinal as well as decorative, came from the forests and fields, and that is why we see so many of our common "wild flowers" seemingly inappropriately growing in the medicinal garden. Let us see for what uses some of these plants are cultivated in the drug gardens of the world.

Belladonna.—The botanical origin of the drug belladonna is the root and mature leaves of *Atropa Belladonna,* a plant belonging to the tomato family, native to Central Europe. The root is from two to three inches thick. From very early times belladonna has been used in German domestic medicine. In 1505 "Le Grand Herbier," an herbal, carried the first authentic note of the plant. Fuchs figured it in 1542, fully identifying its toxic properties, for besides being a useful medicine when taken properly, like many other drugs it is a poison when used improperly. Himly, in 1802, used it in ophthalmology to dilate the pupils of the eyes. Until the twentieth century all the belladonna of commerce had been taken from the wild plant of Germany. Cultivation on a large scale in this country, however, has already been commenced by some of our leading manufacturers of pharmaceutical supplies, and will eventually much increase the accessibility of the drug.

Digitalis.—The drug digitalis is produced from the common fox-glove, a favorite plant of old-fashioned gardens. It is a common biennial or perennial herb throughout the greater part of Europe. The leaves are employed in medicine and should be gathered while the plant is in full bloom. The lower leaves are often a foot or more long and five to six inches broad. Digitalis is a very potent drug, having the effect of reducing the frequency and increasing the force of the heart action, and hence is given in special cases as a sedative.

Podophyllum.—The drug Podophyllum is, as the visitor to the medicinal garden will instantly recognize, no other than the familiar "may-apple" of our southeastern woodlands. Although it is a relatively unimportant drug, it interests us here chiefly because it is one of the ancient remedies used by

the Indian tribes of southeastern North America long before the coming of the white man.

The fruit and underground rootstalk of the may-apple are very effective laxatives. In fact, so drastic is the action of the fruit upon the human constitution that country children are frequently warned that it is poison. When eaten moderately, however, it will cause little discomfort and has a pleasant taste. The powdered and crystalized root-stalk forms the principal ingredient of several sorts of "mandrake" pills offered at drug stores.

"LIVING FOSSILS" IN THE MISSOURI BOTANICAL GARDEN

One is accustomed to think of fossils as objects with no useful purpose other than as museum relics. Such is most frequently the case with animal fossils, it is true, but it is surprising how useful and beautiful plant fossils can be. If the reader is inclined to doubt such a statement, let him consider the beauty of an amber necklace and the wealth of a coal mine. Amber beads are carved from large balls of crude amber frequently buried many feet under the surface of the soil. Such masses of crude amber are the accumulated resin of trees related to our modern pines, which lived many, many centuries before the first man. Some of the commonest amber is taken from the soil of southeastern Africa in places where great forests of resin-producing trees once grew. How do we know? Because the trunks of the trees are still there, although buried in the soil and fossilized or turned to stone as completely as the amber. Imbedded in the drops of amber one can frequently find little bits of the foliage of the forest plants, or even tiny insects embalmed for eternity within the crystalized resin. From such evidence, we know with certainty that a flea or an ant, entangled and smothered in a drop of sticky resin many thousands of years ago, was almost exactly like the little pests of our own day.

But coal is the most important of all plant fossils. It consists almost purely of plant remains packed tightly together ages ago, perhaps becoming a little mouldy and sticky, and eventually being petrified or turned to the stone which

we know as coal. Peat, which is so widely used as fuel in Ireland and other northern European countries, is merely young coal which has not yet petrified.

Coal botanists tell us that coal is formed principally under water in the following ways:

(1) In fresh water: Plants growing beside the edge of a still lake or pool dropped twigs and leaves into the water from time to time. Eventually, after floating aimlessly, these remains became water-logged and sank to the bottom. Continuously, especially during the fall of the year, such deposits were made until the pool became shallow enough for various water-loving plants, as ferns and mosses, to root upon them. These quickened the process of vegetable filling-in until the lake or pool became a bog or swamp. Then small trees and shrubs could root upon the surface and eventually the water was quite displaced and the actual formation of the vegetable mass into coal could begin. The northern parts of North America contain numberless so-called "quaking bogs", which are merely little lakes and ponds which the plants have just managed to fill over. If one steps carefully into the middle of the bog and jumps up and down, the whole bog, plants and all, will gently rise and fall with him.

(2) In salt water: The sea is kept brimful through the continuous supply of fresh water from the rivers which enter it. In the unrecorded past tree trunks and large tangled masses of vegetation drifted down the rivers and out to sea just as they do to-day. These plant masses eventually became water-logged and sank to the bottom some distance from the shore. The currents brought numbers of such plant remains to the same area until a large mass was deposited on the sea floor. Finally the currents of the sea changed somewhat, bringing quantities of mud and sand which covered the vegetable mass, forming, after thousands of centuries, a "seam" of coal. And that is why, in many parts of the world, coal mines reach far out from the surface of the land, and men work for their living below the bottom of the sea.

By treating plant remains found in coal and other mineral deposits with different sorts of acids and other reagents,

botanists have been able to tell us much about the plants which lived long before the earliest known ancestors of man. And, strange to say, many of the plants which then flourished have been found still to grow upon the earth. Such plants are very aptly called "living fossils." As one writer has appropriately phrased it, these plants "belong to the fossil world as a belated November rose belongs to the summer." In the greenhouses and about the lawns of the Missouri Botanical Garden one may find several examples of these living fossils, and may piece together for himself a fairly satisfying picture of what the world's vegetation looked like millions of years ago.

Ginkgo tree.—One of the most fascinating of living fossils is the ginkgo, or maidenhair tree. Several superb specimens of this handsome tree grow in the Garden lawns. Old plants are tall, handsome trees with noble trunks and many sturdy branches. The leaves grow on little side shoots, and their resemblance to the enlarged fronds of the maidenhair fern is the reason for the popular name.

Had this tree not been held sacred in China and Japan it would long since have been utterly extinct, for it is known only in cultivation. As much for its beauty and size as for its rarity, it was grown in temple gardens in eastern Asia, and was looked upon with reverence and awe by the worshipers. The exact time of the cultivation of the ginkgo as a part of the old temple gardens is lost in the remote past, but it is probably as old as the foundations of eastern religion itself, for the tree is now only found as a fossil in rocks and never growing wild. No other plant, save a very few ferns, has leaves at all like those of the ginkgo, so that it is particularly easy to identify the fossil remains, which are abundant. From the evidence found in the rocks it is certain that the tree was once very widely distributed upon the earth.

The poet Keats, always an admirer of beauty, must have had the great antiquity of the ginkgo in mind when he wrote the following lines:

> ". . . . . the trees
> that whisper round a temple soon become
> dear as the temple's self. . . . ."

Cycads.—The cycads, several splendid specimens of which one may find in the fern house, are thought by some students of evolution in the plant kingdom, to represent "stepping stones" from the ferns to the seed plants. The cycads are very tropical-looking plants, and in fact inhabited the warmer parts of the earth during the time of their reign in the vegetable world. They have rather short, rough trunks with a rosette of palm-like leaves at the summit, and might be mistaken for palms. They bear cones, however, which look quite a little like those of an evergreen.

Although they were once very widely distributed, as testified by their remains in rocks of known age, the cycads now rarely grow naturally. Of those which still survive the countless years since the time when they were common constituents of the world's vegetation, one genus is native of America from Florida to Chile, one is confined to western Cuba, and five or six are still extant in Australia, Japan, and southeastern Asia.

Bald cypress.—Like the ginkgo, the bald cypress is a stately tree which is represented by several specimens upon the lawns of the Garden. It is really an "evergreen," but unlike the pines and cedars, it is not always green, for it loses its needles every fall and grows a new crop every spring. For that reason, the bald cypresses in the Garden have not been killed or badly hurt by the city's smoke as have the other "evergreens" which keep their needles from year to year.

The bald cypress is an unusually tall tree, with a shaft as straight and sturdy as the mast of a ship, and relatively slender side branches. It is easily the most conspicuous tree in the Garden. Once the bald cypress lived practically all over the world, for we have specimens of it, petrified, from Siberia, China, Africa, Australia, Antarctica, Greenland, and the Pacific Coast of North America. At the present time it is one of the characteristic "coastal" plants of the lowlands bordering the Atlantic Ocean from southern New Jersey to the Republic of Mexico. Strange to say, it also occurs frequently up the valley of the Mississippi River and its tributaries as far north as southern Missouri and Illinois, which shows us what excellent recorders of geological time plants can be, for the geologists tell us that thou-

sands of centuries ago the Gulf of Mexico extended far up what is now the lower Mississippi Valley. At that time the bald cypress was flourishing as a coastal tree, just as it is to-day, and when the sea receded it was left, not along the coast, but a thousand miles inland.

Pine trees.—Something has already been said concerning the presence of "evergreen" trees in early geological times in connection with the source of amber. The resinous character of pine-wood probably greatly assisted its preservation, and fragments of it are very common in rocks of all ages. Since the pines must keep their needles from year to year, the smoky air of the city has about done for them, and only a few trees are to be found in the Garden. Years ago, Mr. Shaw, the founder of the Garden, planted many pines, as well as other evergreens, and for years the evergreens, or "conifers" as they are more properly called, were one of the glories of the Garden. But that was when the city of St. Louis was far smaller than it is to-day, and factories and apartments were not numerous. From the loss of our conifers alone, it should be only too evident that in remaining in the city the Garden is undergoing hardship and risk in its effort to benefit the citizenry. The establishment of the Gray Summit Extension was therefore a wise move of provision for the future, as well as making it at once possible to grow there many things to be shown at the Garden, of which otherwise the public would be deprived altogether.

Horsetails.—Country people are familiar with the horsetails, or "scouring rushes" as they have been called because of their use by the diligent housewives of colonial New York as substitutes for scrubbing brushes. The horsetails are plants closely related to the ferns, curiously enough, and looking frequently like a small green fishing-rod or a miniature pine tree. They like to grow in sandy moist places generally, and average from four inches to a couple of feet in height.

As one looks at the patch of horsetails growing, as if by accident, just below the concrete wall of the pergola in the Italian garden, it is hard to realize that they are the surviving relatives of enormous trees which greatly resembled them, but on a vast scale. The lepidodendrons and calamites, as the

extinct horsetail trees are now called, were once very common plants. Single fossilized trunks of these giant horsetails, as we find them in the museums, were frequently more than ten feet in diameter. What a peculiar sight the world must have presented in those days! No wonder the animals were so huge and peculiar, since they lived among such peculiar plants.

STUDY TOPICS FOR A GARDEN VISIT

1. The plants of the medicinal plant garden employed as medicine by the American Indian. (Medicinal plant garden.)
2. The effect of climate upon plants. (Various houses, featuring the desert house.)
3. Adaptation to environment of aquatic plants. (Various lily pools and ponds.)
4. Similarities and dissimilarities: the horsetail, the cycad, the pine, and the ginkgo. (The fern house and the lawns of the Garden generally.)
5. Medicinal plants also used as decorative subjects. (Medicinal plant garden and the hardy perennial borders.)
6. Identification of various economic grains: wheat, corn, rice, oats, barley, rye, etc. (Economic garden.)
7. Protective devices of the desert plants. Notice particularly the different kinds of thorns, spines, etc. (Desert house.)
8. The response of various plants to cultivation in the heart of a great city. Notice those which appear to thrive, and those which do not become firmly established in an urban situation. Particularly examine for damage by smoke. (The lawns of the Garden.)

SUGGESTIONS FOR READING

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Peattie, D. C. Cargoes and harvests. 311 pp. New York. 1926.
Pickering, C. Chronological history of plants: Man's record of his own existence illustrated through their names, uses, and companionship. 1222 pp. Boston. 1879.
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Seward, A. C. Links with the past in the plant world. 147 pp. Cambridge. 1911.
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RECORDS OF FIRST BLOOMING OF WILD FLOWERS IN THE VICINITY OF SAINT LOUIS

Every spring there is much interest in the first wild flower to make its appearance after the rigors of winter. While the seasons vary within certain limits, the time of blooming of spring flowers does not vary as much as is generally supposed. In view of the unusually severe winter just past, it seems a particularly favorable time to record for future reference the date at which certain of the common wild plants first bloomed. At the localities indicated, on the dates given, the plants listed below were observed to be in blossom but they may have been in flower a day or two earlier in more favorable localities. The first date only is given; for instance, bloodroot which bloomed on March 9 at Osage Hills might have bloomed at Gray Summit at the same time, or even as late as March 13, but since it was recorded on March 9, a later date at some other place is of no importance so far as the earliest date of flowering for that particular plant is concerned.

OSAGE HILLS (MERAMEC HIGHLANDS)—MARCH 9, 1930

1. Liverleaf (*Hepatica acutiloba* DC.)
2. Bloodroot (*Sanguinaria canadensis* L.)
3. Spring beauty (*Claytonia virginica* L.)

GRAY SUMMIT—MARCH 13, 1930

4. Cut-leaved toothwort or pepper-root (*Dentaria laciniata* Muhl.)
5. Fragrant or sweet-scented sumac (*Rhus canadensis* Marsh.)

GRAY SUMMIT—MARCH 20, 1930

6. Midland adder's-tongue (*Erythronium mesochoreum* Knerr)
7. Rue anemone (*Anemonella thalictroides* (L.) Spach.)
8. Tinted spurge (*Euphorbia commutata* Engelm.)
9. Plantain-leaved everlasting (*Antennaria plantaginifolia* (L.) Rich.)
10. Spice bush (*Benzoin aestivale* (L.) Nees.)
11. Marsh blue violet (*Viola cucullata* Ait.)
12. Wild pansy (*Viola Rafinesquii* Greene)
13. Least bluets (*Houstonia minima* Beck)
14. Harbinger-of-spring (*Erigenia bulbosa* (Michx.) Nutt.)
15. Golden corydalis (*Corydalis aurea* Willd.)
16. Hoary puccoon (*Lithospermum canescens* (Michx.) Lehm.)
17. Carolina whitlow-grass (*Draba caroliniana* Walt.)
18. Wedge-leaved whitlow-grass (*Draba cuneifolia* Nutt.)
19. Virginia rock-cress (*Arabis virginica* (L.) Trel.)

RANKIN ESTATE (ST. LOUIS COUNTY)—MARCH 23, 1930

20. Dutchman's breeches (*Dicentra cucullaria* (L.) Bernh.)
21. Mouse-tail (*Myosurus minimus* L.)
22. Common dandelion (*Taraxacum officinale* Weber)
23. Virginia cowslip or bluebell (*Mertensia virginica* (L.) Link)
24. Blue phlox (*Phlox divaricata* L.)
25. Large-flowered verbena (*Verbena canadensis* (L.) Britton)
26. Common chickweed (*Stellaria media* (L.) Cyrill)
27. Androsace (*Androsace occidentalis* Pursh)
28. American or white elm (*Ulmus americana* L.)
29. Shepherd's purse (*Capsella Bursa-pastoris* (L.) Medic.)
30. White or silver maple (*Acer saccharinum* L.)
31. Cottonwood (*Populus deltoides* Marsh.)

PACIFIC—MARCH 22, 1930

32. Short-fruited whitlow-grass (*Draba brachycarpa* Nutt.)
33. Common juniper (*Juniperus virginiana* L.) Pistillate tree
34. False rue anemone (*Isopyrum biternatum* (Raf.) T. & G.)
35. Shad bush or service berry (*Amelanchier canadensis* (L.) Medic.)
36. Miterwort or two-leaved bishop's cap (*Mitella diphylla* L.)
37. Forbe's saxifrage (*Saxifraga Forbesii* Vasey)

GRAY SUMMIT—APRIL 8, 1930

38. Sessile-flowered wake-robin (*Trillium sessile* L.)
39. American bladder nut (*Staphylea trifolia* L.)
40. Bird-foot violet (*Viola pedata* L.)
41. Wild cranesbill (*Geranium maculatum* L.)
42. Hispid buttercup (*Ranunculus hispidus* Michx.)
43. Small-flowered crowfoot (*Ranunculus abortivus* L.)
44. Wild yellow plum (*Prunus americana* Marsh.)
45. Missouri gooseberry (*Ribes gracile* Michx.)
46. Yellow false garlic (*Nothoscordum bivalve* (L.) Britton)
47. White dog's-tooth violet (*Erythronium albidum* Nutt.)
48. Greek valerian (*Polemonium reptans* L.)
49. Ground ivy (*Nepeta hederacea* (L.) Trevisan)

HOG HOLLOW (JEFFERSON COUNTY)—APRIL 13, 1930

50. Missouri violet (*Viola missouriensis* Greene)
51. Downy yellow violet (*Viola pubescens* Ait.)
52. Striped violet (*Viola striata* Ait.)
53. Lyre-leaved rock cress (*Arabis lyrata* L.)
54. Toothed rock cress (*Arabis dentata* T. & G.)
55. Smooth rock cress (*Arabis laevigata* (Muhl.) Poir.)
56. Blue-eyed Mary (*Collinsia verna* Nutt.)
57. Harvey's buttercup (*Ranunculus Harveyi* (A. Gr.) Britton)

58. Swamp buttercup (*Ranunculus septentrionalis* Poir.)
59. Early or tufted buttercup (*Ranunculus fascicularis* Muhl.)
60. Wild goose plum (*Prunus hortulana* Bailey)
61. Celandine poppy (*Stylophorum diphyllum* (Michx.) Nutt.)
62. Slender plantain (*Plantago elongata* Pursh)
63. Common wood rush (*Luzula campestris* (L.) DC.)
64. Larger ground plum (*Astragalus mexicanus* A. DC.)
65. Emmon's sedge (*Carex varia* Muhl.)
66. Nodding chickweed (*Cerastium nutans* Raf.)

NOTES

Dr. George T. Moore, Director of the Garden, spoke before the Garden Lovers Club of Cincinnati, April 24, on "Orchids."

The University of Illinois Library School, in its biennial inspection visit to libraries, printing and engraving establishments, visited the Garden library, April 17.

Dr. George T. Moore attended the meetings of the American Philosophical Society at Philadelphia, April 25 and 26, and the meeting of the trustees of the American Orchid Society at Philadelphia, April 29.

Recent visitors to the Garden include Mr. S. Kamesam, of the Forest Research Institute, Dehra Dun, India; Mrs. Susan Delano McKelvey, of Boston, author of botanical monographs; Prof. O. C. Schultz, associate professor of botany, Oklahoma A. & M. College, Stillwater, Oklahoma; Prof. H. W. Rickett, assistant professor of botany, University of Missouri.

Mr. George H. Pring, Superintendent of the Garden, has given the following lectures recently: April 8, before the St. Louis Electrical Board of Trade, at the Hotel Statler, on "Spring Work in the Garden"; April 9, before the City Club, on "Orchid Exploration in Panama"; April 10, before the St. Louis Florists' Club, on "Commercial Rose Growing in Panama"; the afternoon of April 17, before the floricultural department of Ohio State University, on "Water Gardens", and the evening of April 17, before an open meeting of faculty and students of Ohio State University, on "Orchids."

STATISTICAL INFORMATION FOR MARCH, 1930

GARDEN ATTENDANCE:

Total number of visitors.....51,291

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought..... 162
Total number of books and pamphlets donated..... 117

PLANT ACCESSIONS:

Total number of plants donated..... 1,116
Total number of packets of seed donated..... 341

HERBARIUM ACCESSIONS:

By Purchase—

Muenscher, W. C.—North American Myxomycetes, Coll. of Wann & Muenscher, Fasc. 1. ed. 2. (Nos. 1-50a)..... 50
University of Minnesota—Reliquiae Holwayanae (South American plant rusts), Fasc. 1-4 (Nos. 1-200), and extra numbers of Holway collection of South American plant rusts not included in fascicles..... 350
Weigel, Th. Oswald—Krieger, W. Schädliche Pilze..... 297
Weigel, Th. Oswald—Weese's "Eumycetes selecti exsiccati," Lief. XVI (Fasc. XVI, Nos. 376-400, inclusive)... 25

By Gift—

Brown, Mrs. J. B.—*Pachysandra terminalis* Sieb. & Zucc. from horticulture 1
Buswell, W. M.—*Ficus ulmifolia* Lam. from horticulture.. 1
Eames, E. H.—Plants of Connecticut..... 52
Kiener, W.—*Oreoxis* sp. from Colorado..... 1
La Garde, Dr. R. V.—*Equisetum* sp. from Missouri..... 1
Rigg, Dr. G. B.—Plants of Washington..... 3
Showalter, Dr. A. M.—*Riccardia pinguis* type C. from culture 1

By Exchange—

Cornell University, by Prof. K. M. Wiegand—Plants of New York..... 544
University of Tennessee, by Prof. H. M. Jennison—Plants of eastern Tennessee..... 100

Total..... 1,426

FLORAL DISPLAYS OF SPECIAL INTEREST IN 1930

In order that readers of the BULLETIN may have a more comprehensive idea of the various flower shows and outdoor exhibits which from month to month may be seen at the Garden, the following tentative schedule is given. While the indoor exhibits can be quite definitely indicated, the blooming period of outdoor plants is subject to variation, depending upon the weather, and out-of-town readers should confirm the date of any display before visiting the Garden.

JANUARY

(Floral Display House)
Orchids, Primroses, and Cyclamen.

FEBRUARY

(Floral Display House)
First half month—Orchids.
Second half month—Cinerarias.

MARCH

(Floral Display House)
March 1-17—Bulb Show.
March 20-23—St. Louis Florists' Show.
March 29—Azalea Show.

APRIL

(Floral Display House)
Azaleas, Roses, Schizanthus.
(Outdoors)
Pansies, English Daisies, Early-flowering Shrubs.

MAY

(Floral Display House)
Hybrid Pelargoniums, Salpiglossis, Begonias, Marguerites, Lupines, and other spring annuals.
(Outdoors)
Bulbs (early in month), Hardy Water-lilies, Peonies.
Iris (late in month), Spring-flowering shrubs and perennials.

JUNE

(Outdoors)
Roses, Hollyhocks. Medicinal Garden.

JULY

(Outdoors)
Tropical plants. Annuals. Economic Garden — farm crops, fiber plants, rice, cotton, peanuts, tobacco, sugar-cane. Medicinal Garden.

AUGUST

(Outdoors)
Tropical Water-lilies, Victoria Cruziana, Lotus lilies. Economic Garden. Medicinal Garden.

SEPTEMBER

(Outdoors)
Tropical Water-lilies. Economic Garden. Medicinal Garden.

OCTOBER

(Floral Display House)
Dahlia (novelties and newer varieties).

NOVEMBER

(Floral Display House)
Chrysanthemum Show.

DECEMBER

(Floral Display House)
Poinsettias, Stevias.

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove avenue and Flora place, on the Sarah car line (No. 42). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motorbus lines transfer.

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Missouri Botanical Garden Bulletin

Vol. XVIII MAY, 1930 No. 5

CONTENTS

	Page
The Dogbane: Roadside Weed and Future Staple	87
Notes	104
Statistical Information	105

Floral Displays of Special Interest in 1930

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1930

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OF THE MISSOURI BOTANICAL GARDEN

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A TYPICAL COLONY OF APOCYNUM CANNABINUM, GROWING NEAR CARONDELET, MISSOURI

Missouri Botanical Garden Bulletin

Vol. XVIII MAY, 1930 No. 5

THE DOGBANE: ROADSIDE WEED AND FUTURE STAPLE.

Little does the farmer suspect, as he patiently plows through the patches of hated "dogbane" or "Indian hemp" ever spreading and choking out the grain upon his unproductive soil, that he is actually engaged in cultivating a plant which may prove to be a future staple—a plant of many varied economic uses. If one were to warn him that instead of exterminating the weed he is actually giving it a still greater lease on life, he would scarcely believe it. And if he were told that, properly appreciated, the weed might repay him much better than the stand of grain which he so industriously tends, he would probably laugh. However, especially in the western states, the dogbane, or Indian hemp, as it is sometimes called, is no laughing matter. It is a rank, tough, ugly weed, which can usually flourish upon much poorer soil than the commonly cultivated grains. And instead of having to be resown each year, up it comes without waiting to give the corn, wheat, or whatever the real crop may be, an even start. What a boon it would be if the cultivated crop were so sturdy and trustworthy!

Few of our native plants are more common over a greater part of the United States than the several species of dogbane, or Apocynum, the scientific name for the plant. There is scarcely a roadside or railroad right-of-way which hasn't large and frequent patches of it, and almost every farm in

the country is familiar with it. For in addition to having seeds which are wonderfully fitted for a wide dispersal, the plant possesses a system of thick rootstalks specially constructed for the production of new plants. Upon these rootstalks, which do not reach straight down into the earth as most other roots do, but travel for a long distance just a few inches beneath the surface, a multitude of tiny buds, or root-shoots, are produced, each of which eventually develops into a full-fledged plant. In turn, these plants produce more rootstalks and more little buds. Each time the farmer's plowshare cuts across the under-ground rootstalk, it cuts off one or many of the little root-shoots, casts them to one side or even carries them for a distance, where they eventually settle down to the business of crowding out the crop plants in the neighborhood. Text-figure 1, diagram 3, illustrates the under-ground parts of the dogbane. Plate 15 presents two views of a farm in southern Colorado which has become almost completely covered with plants of *Apocynum medium* var. *lividum*. This variety has never been known to produce seed, and must rely entirely upon propagation by cuttings and root-shoots. Therefore, in all probability, the entire field has become infested through the division of a single plant.

A great number of other plants also reproduce themselves by means of root-shoots, notably the Lombardy poplar and the black locust. This method of propagation is really more effective than seeds; and some plants have given up the production of seeds altogether and can only be multiplied by cuttings or by root-shoots. The Lombardy poplar, which occurs in such numbers over nearly all the western world, can only be reproduced in that way. Every Lombardy poplar in the world is a direct descendant of a single black poplar tree in northern Italy which devoted its energy to the formation of a tall spire instead of a bushy tent like its brothers and sisters. From that single tree, millions of other trees have been propagated by means of cuttings and root-shoots. At the present day a sugar-maple tree, of almost the same tall, slender shape as the Lombardy poplar, is growing in a cemetery in New England. This tree is being carefully watched by nurserymen; and we may eventually have a "Lombardy" maple.

The seeds of the dogbane much resemble those of the common milkweed, having a long comet's-tail of silky hairs which a breath of air may blow about after the seed-pod has burst. Carried into the air they finally land in a place providing suitable conditions for germination and growth.

The two most common popular names of the Apocynum, "Indian hemp" and "dogbane," owe their origin to certain uses which were found for the plant many centuries ago. The species of Apocynum called Indian hemp contain a tough, silky fiber which, from the earliest recorded times, was twisted into crude rope or thread by the Indians of North America. Conspicuous among the domestic articles found in the Cliff Dwellings of the southwestern states are rude fabrics of the fiber from the leaves of the Yucca plant woven with the silky floss of the Apocynum. The Yucca fiber usually forms the substantial warp, while that from the Apocynum constitutes the more delicate woof. Sandals and bowstring were also made from the strong thread taken from the Apocynum stems, and frequently the wooden handles of stone axes were bound with it.

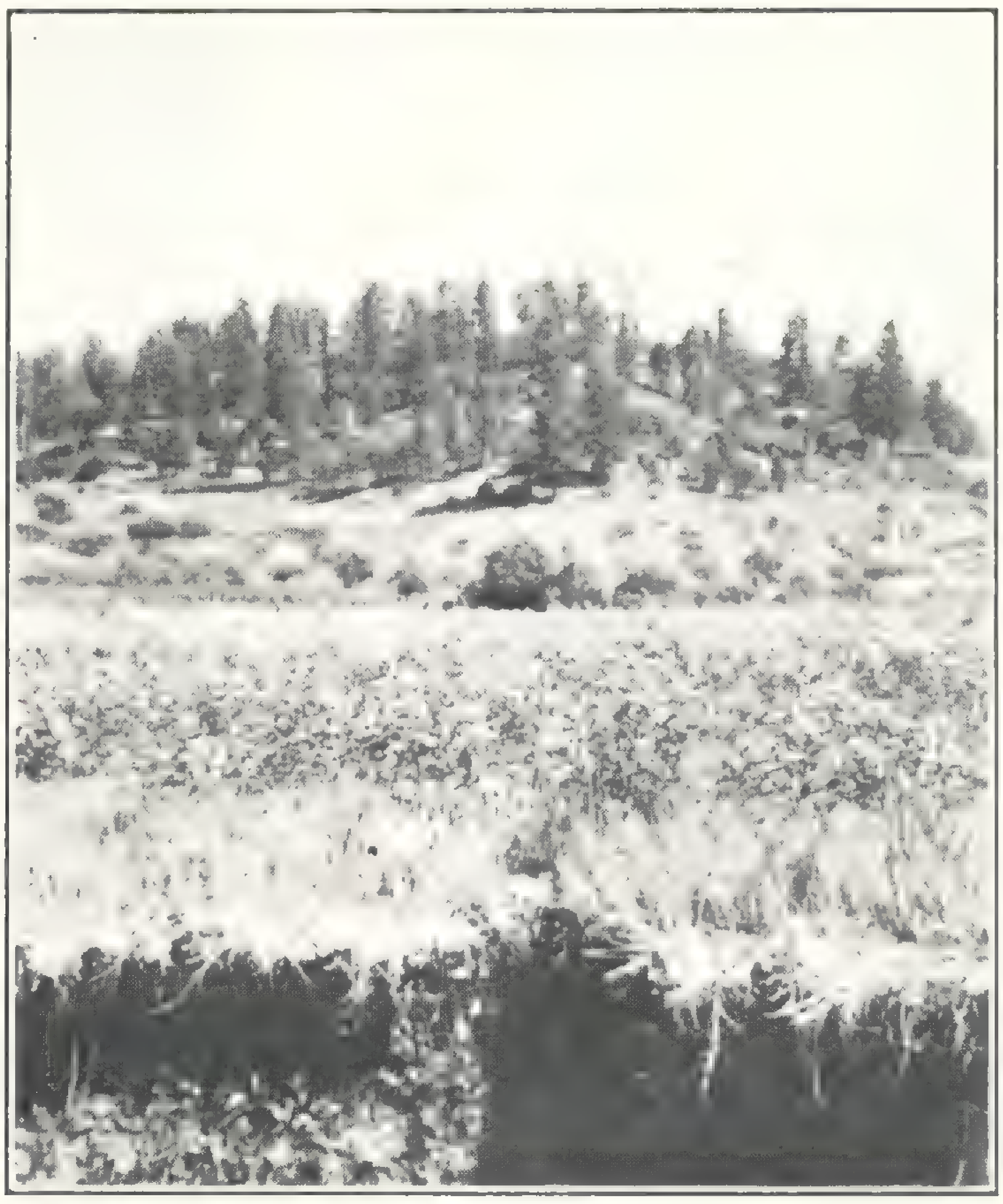
In the eastern sections of the United States, as well as in Canada, the aboriginal inhabitants recognized the fiber of Apocynum as a valuable article. From them the early European settlers learned its use. In the sixteenth century Janus Verrazanus, a Venetian sailor, came upon natives along the shores of South Carolina wearing clothing made of Spanish moss interwoven with cords of Apocynum. From an old book entitled "A brief relation of the discovery and plantation of New England . . . from 1607 to this present 1622" one is informed that the plant called "Indian hemp" by the colonists and "enequen" by the Indians is quite a good substitute for real hemp. Jacques Cartier found natives of the Bay of St. Lawrence region fishing with nets made from the same stuff. Still another record of the plant is given by the old Spanish historian, Alvarado, who related that the famous explorer, De Soto, after losing his ships on the lower Mississippi, built brigantines from native wood, caulking them with "the tow of an herb like hemp, called 'enequen.'"

The name "dogbane" is an instance of a misapplied popular name which has remained in use in spite of the error.

Like the common mayflower (*Podophyllum peltatum*), which many people, botanists included, persist in calling "mandrake," the Apocynum does not deserve to be called "dogbane," a name which rightfully belongs to a plant (*Cynanchum erectum*) found in Greece and around the Adriatic and Mediterranean Seas generally. The real dogbane of Europe received its name from the early Greeks, who used a stew of the stems as a poison for dogs, wolves, rodents, and other animal pests. Hence the name, which is written in Greek as ἀπόκυνον, meaning, "from the dog," or "bane or poison for dogs." In some way or other, the North American plant became confused with the European in the minds of the early botanists. While it is doubtful indeed whether it was ever used to kill dogs, the early botanists were fully justified in regarding the American plant as a potential poison. The poisonous principle of the Apocynum is contained chiefly in the milky juice, or latex, which is found in all parts of the plant. This exudes copiously from a wound, thus resembling the familiar milkweed (Asclepias), as well as the commonly cultivated rubber plant (*Ficus elastica*).

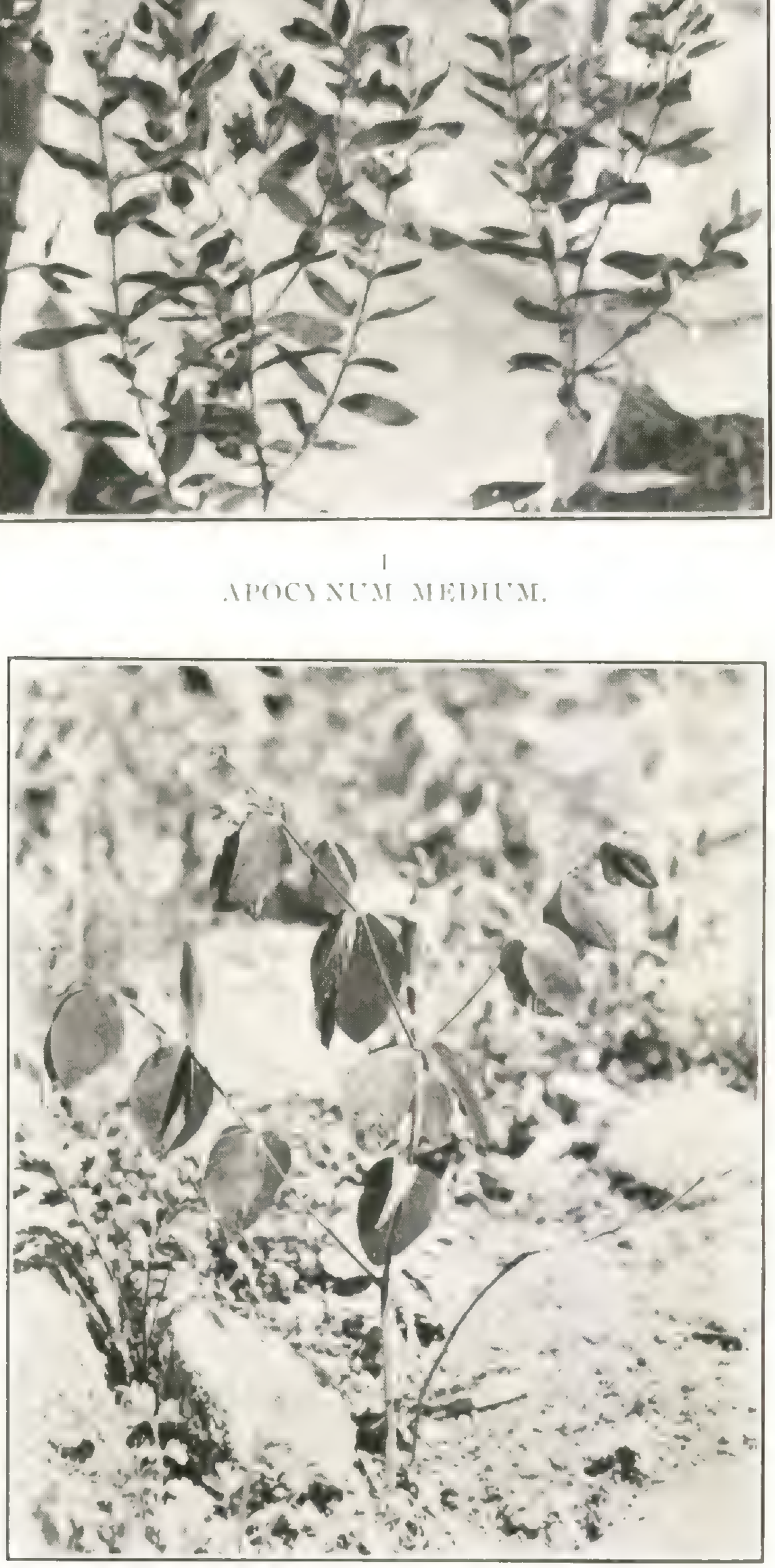
But many poisons are also useful as drugs. This fact is reflected in the word "pharmacy," derived from the Greek word φάρμακον, meaning both a drug and a poison. The root of *Apocynum cannabinum* was widely used as a medicinal herb by the Indians of the southern United States at the time of the first explorations in that region by the white men. Especially among the Choctaws and Cherokees was this practice established. The root was chewed and the juice swallowed as an emetic and diuretic. From the Indians the medicinal use of Apocynum spread to the woodsmen of Kentucky and Tennessee, and so into the materia medica of the nation. It is recognized as officinal in the Pharmacopoeia of the United States, and is recommended in all of the larger pharmaceutical books. In moderate doses an infusion of the dried root of *Apocynum cannabinum* is considered an excellent diuretic, and is recommended for the treatment of dropsy and malaria.

In time of war a nation is compelled to examine and take stock of its natural resources, as at no other period. With certain important sources of raw materials cut off, substitutes



APOCYNUM MEDIUM VAR. LIVIDUM, INFESTING A FIELD NEAR BAYFIELD, COLORADO.

1
APOCYNUM MEDIUM.



2
APOCYNUM ANDROSAEMIFOLIUM.

must be diligently sought. The American people are proverbially resourceful, and during the relatively brief period of their participation in the war of 1914-18 they discovered that they were much less dependent upon the outside world for many commodities than had been suspected. With an army of technical students and workers enlisted in supplying important raw materials, amazing resources were discovered, especially in the products obtained from the native flora. Had the United States been forced to rely for a longer period upon the home production of commodities there might have developed a number of additional important national industries; but with the advent of peace many of the new-found uses for native plants were forgotten or neglected.

One of the most important commodities of civilized life is rubber, and practically all of the plants from which it is produced can be grown successfully only in the tropics and subtropics. During hostilities importation of such important plant products is frequently impossible, and it is then that a nation must turn to its neglected natural resources. Immediately after the entrance of the United States into the war in 1917, the state of California undertook a survey of the rubber-producing plants of the Great Basin and Pacific Coast areas, the work being carried out under the direction of the State Council of Defense and the University of California. This research examined some 225 latex-producing plants of the western United States, eventually centering about several species of Asclepias and Apocynum, or, as they are popularly known, the milkweeds and dogbanes. This was not the first research undertaken to determine the potentialities of native rubbers. As early as 1875 Asclepias was investigated, and in 1912 Fox[1] had found *Apocynum androsaemifolium,* the so-called "spreading dogbane," to have a rubber content of 2.27 per cent. The later studies of the State Council of Defense of California, published by Hall and Long[2] in 1921, proved that the genus Apocynum was not only capable of a much higher percentage

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[1] Fox, C. P. Another Ohio-grown rubber. Ohio Nat. 12: 469. 1912.
[2] Hall, H. M. & Long, F. L. Rubber-content of North American plants. Carnegie Inst. Publ. 313: 1-65. 1921.

of rubber from the milky juice, or latex, but is really the most promising of the North American rubber plants. These authors found *A. cannabinum* to produce as high as 5.1 per cent rubber, of a very superior quality.

One of the most significant factors concerned with the study of the latex of *Apocynum* is that the rubber-content increases to a large extent with drought and infertility of the soil. Fox found that plants grown upon dry, sandy soil at West Akron, Ohio, gave a latex containing 2.27 per cent rubber, while those growing in the swamps of South Akron contained only 1.12 per cent rubber. Similarly, Hall and Long found the highest rubber percentage to be obtained from certain plants growing in the prairies of central Nebraska.

While summarizing the conclusions of their experiments, Hall and Long declare: "The Indian hemp is considered as one of the most promising plants for further investigations. It is true that most of the analyses indicate only a small percentage of rubber, but the high yield of No. 1039 [5.1 per cent], together with the ease of vegetative propagation in poor, sandy soils, and the high quality of the product greatly modifies our opinion of its possibilities."

It is interesting to note[1] that during the recent war the Germans, being unable to import freely, also resorted to the manufacture of rubber from certain common weeds, one of which, *Sonchus oleraceus,* or common sow-thistle, grows as an introduced weed in the United States. Apparently the most important weed so used, however, was a sort of wild lettuce, or Lactuca.

Quite aside from its possible use as a source of rubber of very satisfactory quality, the dogbanes, as it has already been related, provide very good fiber. As early as 1897 the United States Department of Agriculture undertook an investigation of the fiber-producing plants of the world with the intent of bettering the nation's home production of fibers. During the course of this research, the fiber of *Apocynum*

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1 Pearson, H. C. Rubber-producing weeds in Germany. India Rubber World 59: 201. 1919.

cannabinum was spoken of very highly. Dodge[1], who published the results of the investigation, wrote of this fiber:

> "Easily separated from the stalk, and when cleaned is quite fine, long, and tenacious. In color it is light cinnamon as usually seen, though finely prepared specimens are creamy white and remarkably fine and soft; will rank with Asclepias for strength, and is readily obtained, as the stems are long, straight, smooth, and slender. Although paper has not been made of it, it could doubtless be utilized for the purpose. It is principally employed by the North American Indians, who manufactured from it in rude fashion bags, mats, small ornamental baskets, belts, twine, and other cordage, fishing lines, and nets. Among fine specimens received is a fish line, such as is used by the Pai Utes at the Walker River Reservation in Nevada."

Later opinions expressed by experts who have examined Apocynum fiber are that if it could be produced at a cost that would permit it to compete with hemp or jute, it might have a commercial value. Although Apocynum has not been so used, a fair quality of paper has been produced experimentally from *Asclepias syriaca*, our common milkweed. It has been stated that machinery could be constructed both to extract the latex from the plants of Apocynum and to grind the tissue preparatory to the preparation of paper-pulp.[2]

As it has been demonstrated that the dogbane attains its maximum usefulness upon land too arid for agriculture, its economic possibilities are greatly accentuated. With vast stretches of such arid and untillable land lying idle in our western States, and because of the easy propagation of the plant, the remuneration from such a project should be considerable. At any rate, the wisdom of maintaining a permanent national bureau for the discovery and development of native resources should be apparent.

THE GENUS APOCYNUM IN MISSOURI.

The dogbanes are scarcely among the most attractive of our native flowers, and many who have read the preceding account of their economic possibilities probably are unable to

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[1] Dodge, C. R. A descriptive catalogue of useful fiber plants of the world. U. S. Dept. Agr. Fiber Investig. Rept. 9. 1897.

[2] Hall, E. M., & Long, F. L. *l. c.* 60. 1921.

recall ever having seen the plants. However, they are relatively common. True, the least attractive of the species are by far the most frequent. It is a safe supposition that the more attractive a plant may be the more attention it will attract, far out of all proportion to its relative frequency as compared with a less conspicuous although more abundant plant. This is well demonstrated by our native grasses, which it may be assumed are the most widespread and common of our plants, and at the same time the least understood, both by amateur naturalists and trained botanists.

The dogbane shares with the spiderwort, or Tradescantia, the fate of the prophet who is not without honor save in his own country. In Europe, *Apocynum androsaemifolium*, known popularly as the "spreading dogbane," has been cultivated since early days, the exact date of its introduction being unknown. As early as 1688, however, John Ray mentions a plant called "Apocynum flore lilii convallium purpurascente" as appearing in the famous physic garden at Chelsea, so we may safely assume that its actual introduction was in advance of that date. By the last quarter of the eighteenth century it was evidently widely cultivated on the continent and viewed as a curiosity because of its propensity for capturing insects.

Although it is now fully understood that insects trapped within the flowers of Apocynum are probably detained only by the viscous floral secretions, or "nectar", some fantastic explanations have been advanced to account for this phenomenon. The old French biologist, Lamarck, father of one of the early theories of evolution, was of the impression that mechanical pressure exerted by a set of five peg-like nectaries situated within the flower is responsible for catching the proboscis of the insect. A somewhat more current view was that the stamens actually grasp the insects just as do the leaves of the "Venus's fly-trap," Dionaea. Erasmus Darwin,[1] the grandfather of the author of "The Voyage of the Beagle" and "The Origin of Species," appears to have been the first to sponsor this view, and wrote as follows:

"In the Apocynum Androsaemifolium, one kind of Dogsbane,

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1 Darwin, E. The botanic garden. Part 2: The loves of the plants. 126. 1791.

the anthers converge over the nectaries, which consist of five glandular oval corpuscles surrounding the germ; and at the same time admit air to the nectaries at the interstice between each anther. But when a fly inserts its proboscis between these anthers to plunder the honey, they converge closer, and with such violence as to detain the fly which thus generally perishes."

Although it would be wearisome to retell the accounts of many other authors regarding the insect-catching habit of Apocynum, the description of the plant by the anonymous author of "The Journal of a Naturalist"[1] should be included as perhaps the most fabulous of all:

> "But we have one plant in our garden, a native of North America, than which none can be more cruelly destructive of animal life, the dogsbane (apocynum androsaemifolium) which is generally conducive to the death of every fly that settles upon it. Allured by the honey on the nectary of the expanded blossom, the instant the trunk is protruded to feed on it, the filaments close, and catching the fly by the extremity of its proboscis, detain the poor prisoner writhing in protracted struggles until released by death, a death apparently occasioned by exhaustion alone; the filaments then relax, and the body falls to the ground. The plant will at times be dusky from the numbers of imprisoned wretches. This elastic action of the filaments may be conducive to the fertilization of the seed by scattering the pollen from the anthers, as in the case of the berberry; but we are not sensible, that the destruction of the creatures which excite the action is in any way essential to the wants or perfection of the plant, and our ignorance favours the idea of wanton cruelty in the herb; but how little of the causes and motives of action of created things do we know!"

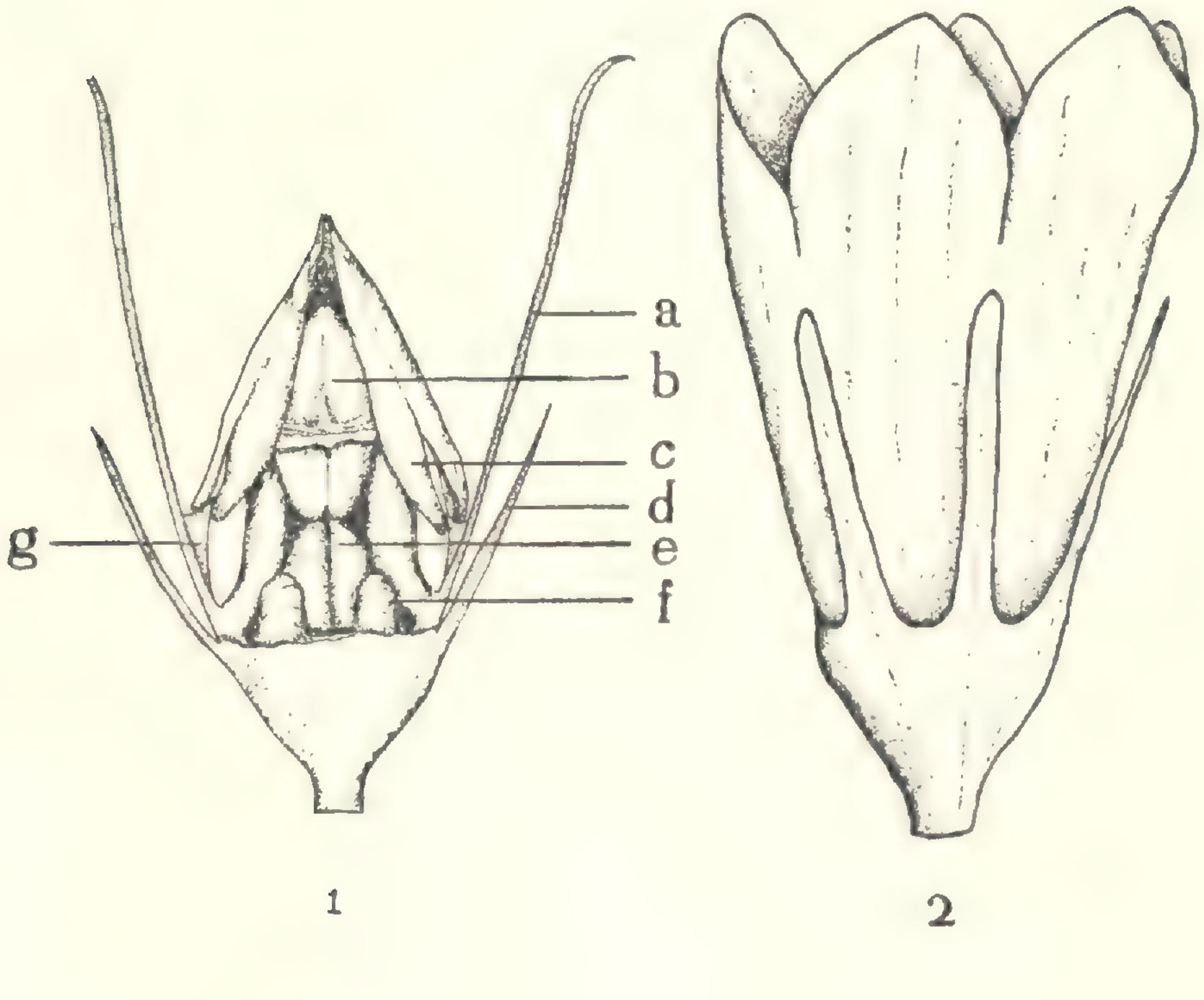
This highly fictitious narrative is illustrated by a sketch showing the flower of *Apocynum androsaemifolium* before: with outspread stamens awaiting the visit of the victim; and after: with the anthers pressed tightly about a fly. In justice to the plant, and deference to the eager public which might throng to the nearest patch of dogbane to watch the strange phenomena described above, it must be said that the dogbane is not as cruel an herb as the account might lead one to believe. The number of insects caught is relatively few; there is not a spectacular elastic movement of the stamens; and the prisoner may stay until it dries up for all the move-

[1] Anon. The journal of a naturalist. 80-81. 1829.

ment which the plant makes to let "the body" fall to the ground. The last statement of Erasmus Darwin, however, or rather the moral to be drawn from it, alone remains significant.

In order to illustrate the vivid tales of how the dogbane catches flies, and also to show the reproductive organs of the plant, a drawing of the floral organs of *Apocynum androsaemifolium* is herewith reproduced. The exterior of the flower of *A. androsaemifolium* is typical, in its general structure, of the genus Apocynum (diagram 2, fig. 1). The appearance as a whole is not unlike that of a large five-lobed bowl set within a shallow, five-pointed saucer. The bowl is the corolla of the flower, which represents the fusion of five separate petals, as we frequently see in such flowers as the wild rose, geranium, and the violet. The saucer is the calyx, which also represents the fusion of five sepals. The corolla is tube- or bell-shaped. and varies in color from greenish-white to a clear, pearly white striped with pink. The length varies from about one-eighth to one-quarter inch, which accounts for the fact that this plant has not been cultivated for decorative purposes. The green calyx varies from a length equalling that of the corolla in the small-flowered species, to about one-third the length of the corolla of the large-flowered forms.

Diagram 1 of text-fig. 1 illustrates the condition of the organs within the flower. A portion of the calyx and corolla has been removed to show the center of the flower. In the very center is the pistil, which consists of a barrel-shaped style (*b*) resting upon the tops of the two ovaries (*e*). Within the ovaries are many small, round ovules, which eventually form the seeds. Pressed tightly about the style are five stamens which alternate in position with the five lobes of the corolla. The stamens consist of an arrow-shaped anther (*c*), which bears the pollen, and a stalk, or filament, which supports the anther, and attaches it to the base of the corolla. Alternating, in turn, with the filaments of the stamens are five plug-like nectaries (*f*), which secrete the nectar. Such a great quantity of nectar is secreted by these little organs and so fond of it are the honey-bees in particular, that whole fields are allowed to become filled with certain species of Apocynum in order that the bees may obtain the nectar.



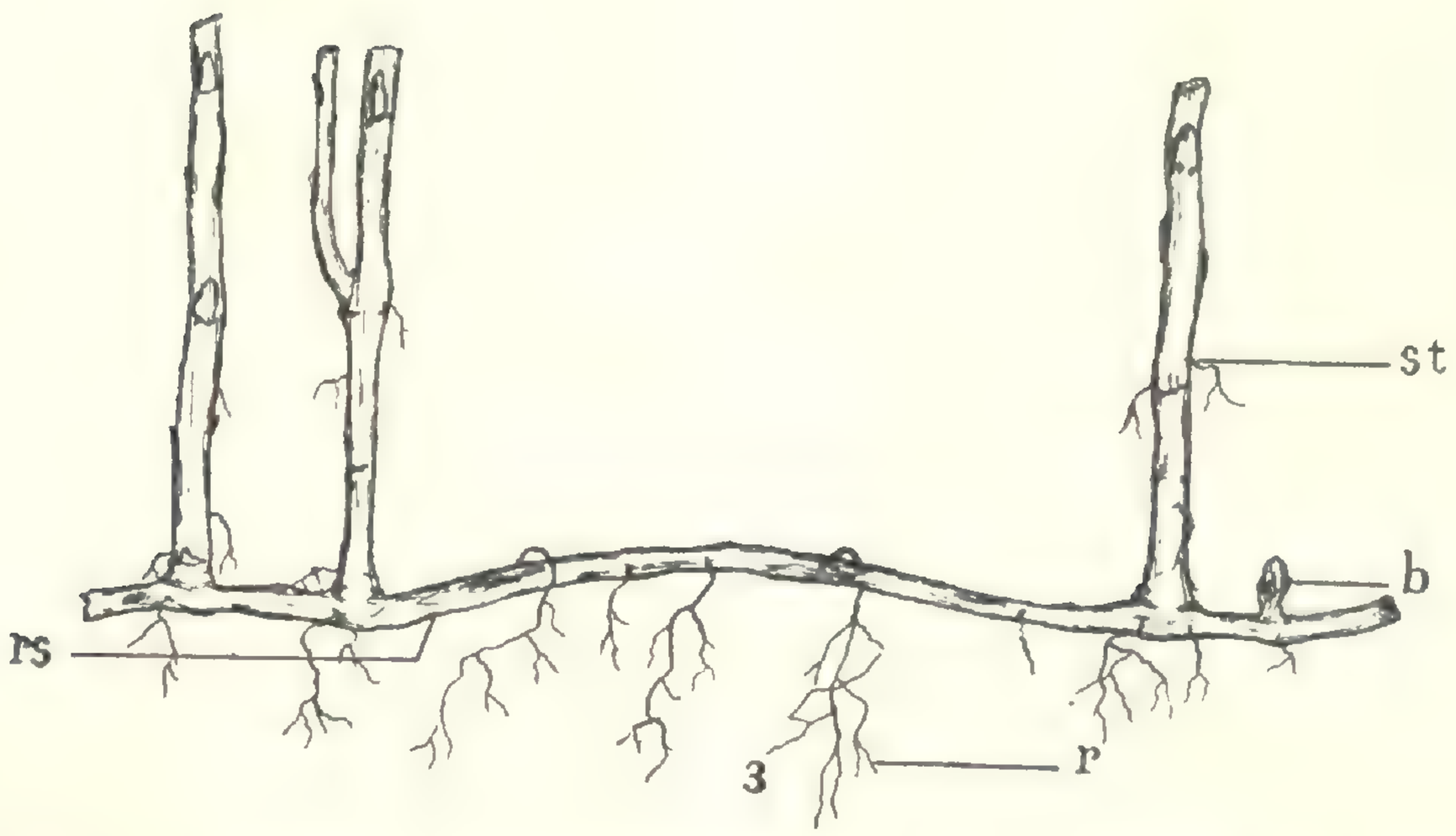


Fig. 1. *Apocynum androsaemifolium:* diagram 1, showing the condition of the organs within the flower—*a,* corolla-lobe, *b,* style, *c,* anther, *d,* calyx, *e,* ovary, *f,* nectary, *g,* scale; diagram 2, exterior of flower; diagram 3—*st,* stem upon which leaves and flowers are borne, *r,* true roots which absorb moisture from the soil, *rs,* the root-stalk which produces the buds, or root-shoots (*b*).

In addition to the organs described above, five peculiar-shaped appendages, or scales (*g*), are attached to the inside of the corolla, and are placed alternate with the stamens and opposite the lobes of the corolla (*a*). With all the parts of the flower arranged in fives and fitting closely within one another like a tiny Chinese puzzle, all covered with sticky nectar, is it strange that the smaller of the visiting insects frequently wedge their proboscides far down into the center, only to find when it is too late that they have been trapped alive?

Passing reference to the stem of Apocynum has been made in the preceding account of the economic possibilities of the genus. The stem is always more or less erect, branching from time to time, and is strictly perennial. The mode of branching, however, is frequently characteristic of certain species. In *A. cannabinum* and *A. hypericifolium* and their varieties, two branches nearly always arise at nearly the same place upon the stem, while in *A. androsaemifolium* and *A. medium* the branches usually occur one at a time. Such branches are usually called "opposite" and "alternate," respectively.

The leaves of Apocynum vary greatly in size and outline, but an important peculiarity is the position which they assume upon the stem. The leaves of *A. androsaemifolium* always droop, as will be seen in pl. 16, fig. 2. On the other hand, the leaves of *A. cannabinum* and *A. hypericifolium* ascend, as is shown in pl. 14. The leaves of *A. medium* neither droop nor ascend, but are held nearly straight out from the stem, as is shown in pl. 16, fig. 1.

The flowers are very numerous, and are arranged in dense inflorescences placed nearly always at the ends of the stems or branches. The flowers of *A. androsaemifolium* usually nod somewhat, while those of the other species are nearly always erect.

The fruit consists of two long, narrow seed-pods, joined at the base and diverging widely, which hang from the branches like a pair of compasses or dividers. The seeds each have a conspicuous tuft of silky hairs at one end, like that of the common milkweed.

In order that the species of Apocynum which grow in Missouri may be better understood, a key for the determination

of the various species and varieties has been prepared. Following the key each of the plants is briefly described, the common names listed, and the localities where found, according to specimens deposited in the herbarium at the Garden, arranged according to counties.

KEY TO THE DOGBANES OF MISSOURI.

a. Leaves drooping or spreading; corolla at least twice the length of the calyx-lobes, white or pinkish.
  b. Leaves drooping; corolla at least three times the length of the calyx-lobes, pinkish.....*1. Apocynum androsaemifolium* var. *incanum*
  bb. Leaves spreading; corolla about twice the length of the calyx-lobes, white.
    c. Leaves downy or woolly....*2. Apocynum medium*
    cc. Leaves smooth and rather waxy .....*2a. Apocynum medium* var. *leuconeuron*

aa. Leaves ascending, not drooping or spreading; corolla scarcely longer than the calyx-lobes, greenish-white.
  b. Leaves with definite stalks or petioles.
    c. Plant downy or woolly, at least the lower surface of the leaves.
      d. Only the lower surface of the leaves downy; plant otherwise smooth and waxy.*3. Apocynum cannabinum*
      dd. Entire plant downy or woolly .....*3a. Apocynum cannabinum* var. *pubescens*
    cc. Entire plant smooth and waxy .....*3b. Apocynum cannabinum* var. *glaberrimum*
  bb. Leaves without stalks or petioles, or the latter very short, frequently clasping the stem.
    c. Leaves oblong, tapered at the tip .....*4. Apocynum hypericifolium*
    cc. Leaves nearly round, not tapered at the tip.....*4a. Apocynum hypericifolium* var. *cordigerum*

1. Apocynum androsaemifolium L. var. **incanum** A. DC.

Preferred popular name: spreading dogbane.

Other popular names: dogbane, dogsbane, black Indian hemp, honey-bloom, bitter dogsbane, milkweed, bitter-root, catchfly, flytrap, ipecac, Indian ipecac, wandering milkweed.

This is the prettiest of our native dogbanes. It forms mats of rather low, spreading plants from six to eighteen inches tall. The leaves are usually dark green, and softly downy or woolly on the lower surface. The spreading dogbane native to Missouri is the same variety which is common in the eastern United States. The true *A. androsaemifolium* is an entirely smooth or waxy plant which is generally found only west of the Rocky Mountains. Plate 16, fig. 2, is a photograph of this species growing at Estes Park, Colorado.

Specimens collected in Missouri: BARRY CO.: Eagle Rock, uncommon, near spring, June 26, 1897, *B. F. Bush*. CLARK CO.: Dumas, rocky banks, July 6, 1909, *B. F. Bush*. HOWELL CO.: exact locality lacking, Aug. 12, 1892, *B. F. Bush*. JASPER CO.: Joplin, rocky ground, June 7, 1909, *E. J. Palmer;* rare and local, a clump at Castle Rock, Turkey Creek, near Joplin, June 7, 1909, *E. J. Palmer;* open rocky woods, north slope of Turkey Creek, near Joplin, June 22, 1928, *E. J. Palmer*. PHELPS CO.: Jerome, June 16, 1914, *J. H. Kellogg*. ST. LOUIS CO.: rocky hills, May 15, 1896, *H. Eggert*. WRIGHT CO.: thickets along rocky creek near Mansfield, June 25, 1928, *E. J. Palmer*.

2. Apocynum medium Greene

Preferred popular name: intermediate dogbane.

Other popular name: Miller's dogbane.

This plant is somewhat similar to the preceding, but is taller and more erect in habit, frequently attaining a height of two or three feet. The corolla is usually a clear white, but may occasionally be found slightly rose-tinted. It averages about one-sixth inch long. The whole plant is frequently downy or woolly, and the under-surface of the leaves and the calyx always so.

Specimens collected in Missouri: JASPER CO.: Joplin,

rocky wooded hillsides, *E. J. Palmer.* MACON CO.: Ethel, June 12, 1915, *B. F. Bush.* SHANNON CO.: Montier, common, June 30, 1894, *B. F. Bush.* VERNON CO.: exact locality and date lacking, *G. C. Broadhead.* WRIGHT CO.: Mansfield, alt. 1450 ft., June 12, 1911, *O. E. Lansing.*

2a. Apocynum medium Greene var. **leuconeuron** (Greene) Woodson

Preferred popular name: white-veined dogbane.

This variety is almost exactly like the preceding species, except for the fact that the leaves are absolutely smooth and waxy. A good photograph of this variety growing in Mount Olivet Cemetery, Hannibal, Missouri, is reproduced in pl. 16, fig. 1.

Specimens collected in Missouri: JACKSON CO.: clayey hills, only found near Little Blue as yet, June 24, 1884, *B. F. Bush;* loose sand-hills, July 3, 1898, *K. K. Mackenzie;* Cockerell, July 3, 1898, common in barrens, *B. F. Bush.* MARION CO.: Mt. Olivet Cemetery, Hannibal, waste fields, July 21, 1914, *J. Davis;* northeast corner of Mt. Olivet Cemetery, July 23, 1927, *R. E. Woodson, Jr. & H. L. Fuller.* PHELPS CO.: Jerome, May 24, 1914, *J. H. Kellogg.* PIKE CO.: Clarksville Depot, June 16, 1914, *J. Davis;* railroad bank, opposite depot, July 23, 1927, *R. E. Woodson, Jr. & H. L. Fuller.*

3. Apocynum cannabinum L.

Preferred popular name: Indian hemp.

Other popular names: army root, choctaw root.

This is the largest species of the genus Apocynum. It is usually tall and bushy for an herbaceous perennial, and frequently attains a height of four to six feet. The flowers are produced in great quantities, but the individual blossoms are relatively inconspicuous. The corolla is greenish-white, and is usually about one-eighth inch long. The plant is generally smooth except for the under-surfaces of the leaves, which are somewhat downy or woolly. This is our commonest species, and occurs over the entire United States. It is frequent in neglected farms, and along roadsides and railroad right-of-ways. A photograph showing a typical colony of *A. canna-*

binum growing near Carondelet, Missouri, is presented in pl. 14.

Specimens collected in Missouri: IRON CO.: near summit of Pilot Knob, May 21, 1927, *R. E. Woodson, Jr.* ST. LOUIS CO.: Allenton, June 30, 1912, *G. Letterman;* barrens, Wild Horse Creek Valley, June 16, 1918, *Hoffmann.* STONE CO.: rocky ledges, high hills, May 28, 1914, *E. J. Palmer.* PHELPS CO.: Jerome, June 6, 1914, *J. H. Kellogg.*

3a. Apocynum cannabinum L. var. **pubescens** (Mitchell) A. DC.

Preferred popular name: velvet dogbane.

This variety is quite similar to the preceding species, but is downy or woolly throughout, usually less tall and bushy, and the leaves are frequently much broader. Also a familiar roadside plant.

Specimens collected in Missouri: IRON CO.: Shut-In, Arcadia, May 8, 1925, *R. E. Woodson, Jr.* JACKSON CO.: Courtney, dry ground, Aug. 2, 1906, *B. F. Bush;* Swope Park, Kansas City, barrens, July 21, 1915, *B. F. Bush;* Dodson, June 6, 1913, rocky barrens, *B. F. Bush.* JASPER CO.: Webb City, prairies, June 23, 1911, *E. J. Palmer;* upland prairies, near Asbury, June 23, 1928, *E. J. Palmer;* Forest Mill, June 23, 1909, *E. J. Palmer.* LINCOLN CO.: Moscow Mills, June 23, 1927, *R. E. Woodson, Jr.* MARION CO.: dry open slope beside Ely Street, Hannibal, Aug. 21, 1914, *J. Davis.* RALLS CO.: south of Oakwood, July 16, 1915, *J. Davis*: ST. LOUIS CO.: Allenton, July 30, 1901, *G. Letterman;* near Cliff Cave, July 29, 1886, *H. Eggert;* near Webster Groves, railroad embankment, July 25, 1927, *R. E. Woodson, Jr.;* Jefferson Barracks, June 17, 1890, *A. S. Hitchcock.* WRIGHT CO.: Mansfield, frequent, open woods, etc., alt. 1480 ft., June 5-12, 1911, *O. E. Lansing.*

3b. Apocynum cannabinum L. var. **glaberrimum** A. DC.

Preferred popular name: Canadian hemp.

This plant is also similar to *A. cannabinum* L., but is absolutely smooth or waxy. It is a common roadside and field weed.

Specimens collected in Missouri: CASS CO.: bottoms, June 14, 1865, *G. C. Broadhead.* CLAY CO.: common in open grounds, Randolph, July 17, 1898, *K. K. Mackenzie.* JEFFERSON CO.: roadside south of Festus, May 31, 1926, *R. E. Woodson, Jr.* JACKSON CO.: Sheffield, common in fields, July 10, 1899, *B. F. Bush.* JASPER CO.: Webb City, rocky woods, Aug. 6, 1920, *B. F. Bush;* Carterville, July 13, 1920, *E. J. Palmer;* Reeds, June 28, 1913, *E. J. Palmer;* Sarcoxie, rocky woods, Sept. 18, 1910, *E. J. Palmer.* MADISON CO.: Mine LaMotte, June 22, 1897, *J. T. Monell.* RALLS CO.: uncultivated field near New London, Aug. 24, 1927, *R. E. Woodson, Jr.* ST. CHARLES CO.: near Gilmore, July 18, 1927, *R. E. Woodson, Jr.* ST. LOUIS CO.: in open woods, rather damp places, June, 1833, *G. Engelmann;* Allenton, June 8, 1896, *J. H. Kellogg;* Frisco R. R. embankment, near Webster Groves, July 22, 1927, *R. E. Woodson, Jr.;* Cliff Cave, May 9, 1879, *H. Eggert.* WRIGHT CO.: Cedar Gap, hillsides, alt. 1675 ft., May 22-June 2, 1911, *O. E. Lansing.*

4. Apocynum hypericifolium Ait.

Preferred popular name: clasping-leaved dogbane.

This species is distinguished from *A. cannabinum* and its varieties chiefly by the conspicuously clasping leaves, which usually lack a petiole, or leaf-stalk. Beside the character of the foliage, botanists also are able to recognize additional differences. This species is chiefly found in the northeastern United States and southeastern Canada, where *A. cannabinum* is relatively rare. It thrives upon stream-banks and sandy places.

Specimens collected in Missouri: JACKSON CO.: open dry bank, Dodson, June 9, 1917, *Hoffman.* ST. LOUIS CO.: banks of the Mississippi, below St. Louis, August, 1863, *G. Engelmann.*

4a. Apocynum hypericifolium Ait. var. **cordigerum** (Greene) Bég. & Bel.

Preferred popular name: prairie dogbane.

This variety differs from *A. hypericifolium* in its conspicuously broad, round, and heart-shaped leaves, which have

given rise to its scientific name. It is found chiefly in the northern prairie states of the Dakotas, Nebraska, Minnesota, and Iowa. Missouri evidently is its most southern extension.

Specimens collected in Missouri: JACKSON CO.: Ethel, June 12, 1915, *B. F. Bush.* MACON CO.: four miles east of Blue Springs, in an uncultivated field, July 3, 1926, *A. A. Heller.*

R. E. W., JR.

NOTES

In the exhibition of the work of the School of Occupational Therapy held in the school building, May 1, were examples of the work done in the course in gardening at the Garden. Flats of different kinds of cuttings and of seedlings, potted plants grown from seeds, miniature rock gardens, and arrangements of blooming plants were displayed. Photographs of the best miniature rock gardens and of the indoor gardens planted in the experimental greenhouse at the Garden, together with outlines of the lectures held during the summer semester, completed the exhibit.

Mr. G. H. Pring, Superintendent of the Garden, spoke before the South Side Optimists' Club at its luncheon at Bevo Mill, May 15, on "Some Experiences in the Jungles of Panama"; and in the evening he addressed the Men's Club of the Union Avenue Christian Church on "The Orchids in the Missouri Botanical Garden Tropical Station, Balboa, Canal Zone."

The annual flower sermon, provided for in the will of Henry Shaw, was preached at Christ Church Cathedral, on May 11, by the Rev. Robert Norwood, D. D., Rector of St. Bartholomew's Church, New York City.

Professor H. W. Rickett, accompanied by the instructors and students in the Department of Botany of the University of Missouri, spent the day at the Garden, May 17, visiting the library, herbarium, and greenhouses.

The February-April number of the Annals of the Missouri Botanical Garden, containing "Studies in the Apocynaceae. I", by Dr. Robert E. Woodson, Jr., has recently been issued.

Dr. George T. Moore, Director of the Garden, spoke before the Webster Groves High School, May 9, on "Movement in Plants." The lecture was illustrated with moving pictures.

STATISTICAL INFORMATION FOR APRIL, 1930

GARDEN ATTENDANCE:

Total number of visitors.....29,483

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought.....	170
Total number of books and pamphlets donated.....	71

PLANT ACCESSIONS:

Total number of packets of seed donated.....	260

PLANT DISTRIBUTION:

Total number of plants distributed as gifts.....	17

HERBARIUM ACCESSIONS:

By Purchase—

Venturi, Dr. S.—Plants of Argentina.....	340

By Gift—

Bovard, Mrs. O. Kirby—*Senecio salignus* DC. from Arizona	1
Connell, Mrs. W. H.—*Carex varia* Muhl. and *C. varia* var. *colorata* Bailey from Arkansas.....	2

By Exchange—

Cabrera, Dr. Angel L.—Plants of Argentina.....	14
Field Museum of Natural History, by Dr. E. E. Sherff— Plants of Hawaii.....	2
New York Botanical Garden, by Percy Wilson— *Malvaviscus grandiflorus* HBK, from horticulture.....	1
New York Botanical Garden, by Percy Wilson— *Conium maculatum* L. from Colombia.....	1
New York Botanical Garden, by Dr. H. H. Rusby— Plants of Bolivia collected by G. H. H. Tate.....	11
United States National Museum, by E. P. Killip— Plants of Peru and Brazil.....	103
University of California—Miscellaneous herbarium duplicates	655
University of Montana, by Miss Esther Larsen— Plants of Montana.....	2

By Transfer—

Greenhouse of Missouri Botanical Garden—Cultivated specimens of orchids.....	4
Total	1,136

FLORAL DISPLAYS OF SPECIAL INTEREST IN 1930

In order that readers of the BULLETIN may have a more comprehensive idea of the various flower shows and outdoor exhibits which from month to month may be seen at the Garden, the following tentative schedule is given. While the indoor exhibits can be quite definitely indicated, the blooming period of outdoor plants is subject to variation, depending upon the weather, and out-of-town readers should confirm the date of any display before visiting the Garden.

JANUARY

(Floral Display House)
Orchids, Primroses, and Cyclamen.

FEBRUARY

(Floral Display House)
First half month—Orchids.
Second half month—Cinerarias.

MARCH

(Floral Display House)
March 1-17—Bulb Show.
March 20-23—St. Louis Florists' Show.
March 29—Azalea Show.

APRIL

(Floral Display House)
Azaleas, Roses, Schizanthus.
(Outdoors)
Pansies, English Daisies, Early-flowering Shrubs.

MAY

(Floral Display House)
Hybrid Pelargoniums, Salpiglossis, Begonias, Marguerites, Lupines, and other spring annuals.
(Outdoors)
Bulbs (early in month), Hardy Water-lilies, Peonies.
Iris (late in month), Spring-flowering shrubs and perennials.

JUNE

(Outdoors)
Roses, Hollyhocks. Medicinal Garden.

JULY

(Outdoors)
Tropical plants. Annuals. Economic Garden—farm crops, fiber plants, rice, cotton, peanuts, tobacco, sugar-cane. Medicinal Garden.

AUGUST

(Outdoors)
Tropical Water-lilies, Victoria Cruziana, Lotus lilies. Economic Garden. Medicinal Garden.

SEPTEMBER

(Outdoors)
Tropical Water-lilies. Economic Garden. Medicinal Garden.

OCTOBER

(Floral Display House)
Dahlia (novelties and newer varieties).

NOVEMBER

(Floral Display House)
Chrysanthemum Show.

DECEMBER

(Floral Display House)
Poinsettias, Stevias.

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove avenue and Flora place, on the Sarah car line (No. 42). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motorbus lines transfer.

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Missouri Botanical Garden Bulletin

Vol. XVIII JUNE, 1930 No. 6

CONTENTS

	Page
Rock Gardens for St. Louis and Vicinity	107
Gray Summit Extension, the Home of a Wealth of Wild Flowers	113
Notes	116
Statistical Information	118
Floral Displays of Special Interest in 1930	

ST. LOUIS, MO.
1930

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GARDEN OF A. D. GOLDMAN, CLAYTON ROAD

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ROCK GARDENS FOR ST. LOUIS AND VICINITY

Of all the types of gardens in which one may specialize, the true rock garden has usually been considered so poorly adapted to St. Louis conditions that it was useless to attempt even a small one. While it is a fact that many of the alpine plants which constitute such an important part of the rock gardens of Europe and of the eastern United States cannot be grown successfully here, there are fortunately many other plants which can be used. Naturally, a form of gardening which has been called "the most intriguing of all" should not be neglected because it is difficult; and at least a few garden lovers in and about St. Louis have demonstrated what can be done with this type of planting.

That there is a growing interest in rock gardens throughout the United States is manifest. Books and magazine articles discuss at length the subject from every standpoint, and there is now available a wealth of literature from which one may learn the essential facts necessary at least to plant such a garden. But a word of caution may not be out of place. If the plants used so successfully in cooler climates are duplicated in rock gardens in this vicinity, the results are almost certain to be disappointing. Heaping up stones may produce a rock pile or even a "rockery", but unless the plants used will establish themselves and survive during the season, by no stretch of the imagination can it be called a garden.

Without attempting to describe the various types of rock

gardens, such as "natural," "artificial," "wall," and to distinguish between them and a so-called "wild garden," it has seemed advisable to give actual results obtained in this part of the country. Consequently there have been selected some of the successful gardens around St. Louis which most nearly approach the rock-garden class. Different types have been chosen illustrating the possibilities of various settings and localities, and it is believed these practical examples will be more beneficial to one contemplating a rock garden than any general discussion on the subject. There is also appended a list of a few of the more recent books on rock gardens which may be consulted at the Garden library.

BOOKS ON ROCK GARDENS

Correvon, H. Rock gardens and alpine plants. New York. 1930.
Cotter, J. L. A simple guide to rock gardening. London. 1930.
Farrer, R. The English rock garden. London. 1919.
Hamblin, S. F. American rock gardens. New York. 1929.
Jenkins, E. H. The rock garden. New York. 1920.
Meredith, L. B. Rock gardens; how to make and maintain them. New York. 1914.
Rockwell, F. F. Rock gardens. New York. 1928.
Thomas, H. H. Rock gardening for amateurs. London. 1914.
Wilder, L. B. Pleasures and problems of a rock garden. Garden City. 1928.

A. D. Goldman, Clayton Road (pl. 17).—Passing through an interesting walled formal garden, which must have been beautiful in tulip time, one steps on to an open lawn shaded by large oaks. At a distance is seen a mass plantation of pines, spruces, arborvitae, cedars, and deciduous trees and shrubs, behind which a delightfully arranged rock garden is hidden. This garden is 100 x 150 feet and slopes toward the west. Small hills and rock glades with interwinding walks compose the entire area except the western portion, where a small waterfall with a rustic bridge is featured. In the early spring color effect is produced by bulb plants, such as snowdrops, muscari, crocus, scillas, tulips, *Iris pumila,* followed by aubrietias, phlox, arabis, primroses, anchusas, *Polemonium reptans, Lychnis alpina,* and *Saxifraga orbicularis.*

On May 15 the following plants were noted in flower:

GARDEN OF F. C. THOMPSON, BIG BEND ROAD,
WEBSTER GROVES

ROCK HILL PLANTED WITH SAXIFRAGA SARMENTOSA AND PACHYSANDRA TERMINALIS

SAXIFRAGA SARMENTOSA IN FLOWER

GARDEN OF E. C. THOMPSON, BIG BEND ROAD,
WEBSTER GROVES

ranunculus, iris, dianthus in variety, *Helianthemum Chamaecistus* var. *mutabile* (sun rose), linum, *Geum* "Mrs. Bradshaw," *Lychnis Viscaria* var. *splendens, Salvia azurea,* sedums in variety, *Geranium sanguineum, Veronica repens, Cerastium tomentosum,* Leontopodium (edelweiss), *Armeria vulgaris* var. *splendens, Festuca glauca, Filipendula hexapetala (Spiraea Filipendula), Ajuga reptans, Verbena canadensis,* cypripedium (lady's slipper in bud). A small clump of *Daphne Cneorum* planted three years ago evidently will succumb, due to the effect of the past winter.

F. C. Thompson, Big Bend Road, Webster Groves (pls. 18-19).—For the last twenty years Mr. Thompson has devoted his efforts to bringing together the largest possible collection of shade-loving rock plants, the greater number being either local or North American species. The rock garden is situated in the southwestern part of his estate. Its contour is a gradual slope of twenty feet from north to southwest, and a northern exposure is created by massive trees which shelter it on the south. The garden is an irregular glade formation, with interwinding walks of stepping-stones and ledges. Through the middle eleven pools are connected by a series of cascades which finally terminate in an irregular pond, 150 feet long, planted with domestic water-lilies. An electric water pump forces the water up hill from the lake to the upper cascade, whence it again falls down the series of cascades into the lake.

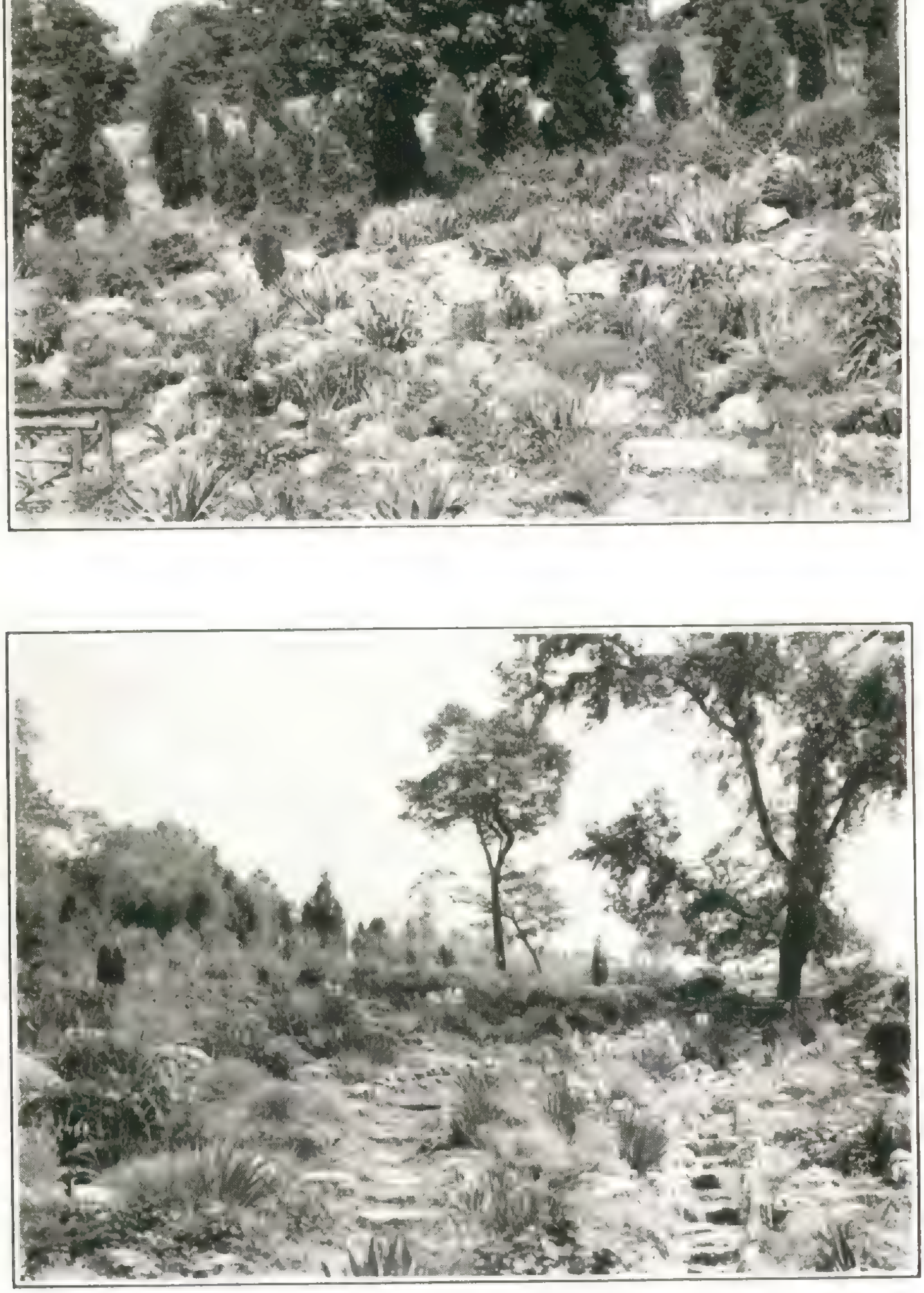
The first impression of the garden is that of a beautiful fern glen. Some of the earliest-blooming flowers are the native blue-bell *(Mertensia virginica)* and *Phlox divaricata,* planted or naturalized between the native ferns, blood-root, violets in variety, spring-beauty *(Claytonia virginica),* trilliums, dicentras, etc. Mr. Thompson called attention to a rock ledge shaded by tall trees, entirely covered with the tender greenhouse *Saxifraga sarmentosa* and mats of glossy green leaves of *Pachysandra terminalis,* both planted fifteen years ago. A few steps toward the east, in a similar location and position, some interesting ericaceous plants were pointed out with pride: *Gaultheria procumbens* (partridge berry), which has been established for over five years and which flowered for the first time last year; *Epigaea repens* (trailing arbutus), planted summer before last and repre-

sented by several small new shoots. In a more exposed position hidden in a rock pocket *Erica cinerea* has survived the winter without any apparent injury. A group of these plants in the garden at Gray Summit likewise passed through the winter successfully. Last fall Mr. Thompson purchased eighty specimen plants of Rhododendron and Azalea, including *R. maximum, R. catawbiense, R. carolinianum, Azalea calendulacea (R. calendulaceum), A. canescens (R. canescens), A. nudiflora (R. nudiflorum), A. arborescens (R. arborescens),* and *Kalmia latifolia*, most of which were in bloom May 15. Determined to grow rhododendrons with the same degree of success as the partridge berry four feet of ground was replaced with wood soil mixed with twenty sacks of Belgian leaf soil, and a four-inch layer of the latter used as a mulch. Native lilies are well established, attested by a large group of *Lilium philadelphicum*, with stems three feet high and a half-inch thick a foot from the ground. They have flowered well for the past three years and increased in number.

Plants in flower on May 15 included: domestic water-lilies in variety, iris in variety, rhododendrons, azaleas, *Myosotis scorpioides, Tradescantia virginica, Saxifraga sarmentosa, Bellis perennis, Bellis alpina, Helianthemum Chamaecistus* var. *mutabile, Armeria vulgaris* var. *Laucheana*, sedums in variety, columbines, *Campanula carpatica, C. rotundifolia*, primulas, *Cypripedium acaule*, ranunculus, cheiranthus, dianthus in variety, *Veronica incana, Geranium sanguineum, Nepeta Cataria, Ajuga reptans, Arabis alpina*, and *Sarracenia purpurea* which is treated as an annual notwithstanding our local conditions.

Morton May, Brentmoor Park, Clayton (pl. 20).—This combined rock and water garden was begun in 1927 and was extended somewhat in area last spring. The ground slopes toward the northeast and is fully exposed to the sun. The central feature of the design is a series of water-lily pools, two above and one below. From the uppermost pool the water flows under the rock garden into a lower pool to the east, continuing down over a series of cascades under a small stone bridge and out into the lowest pool. A continuous circuit of water is maintained by pumping from the lowest into the uppermost pool. The plants in the pools furnish interest

GARDEN OF MORTON MAY, BRENTMOOR PARK, CLAYTON



GARDEN OF MARK C. STEINBERG, WARSON ROAD, CLAYTON

when the rock plants are past flowering, the two large pools being planted with tropical water-lilies, and the middle pool with smaller water plants, such as water poppy, water hyacinth, and water lettuce.

Between the pools and surrounding them are ledges, glades, and stepping-stones for rock-garden planting. The entire garden is screened with a border plantation of native cedars, pines, willows, wild plum, hawthorn, and shrubs. The rock garden is most effective during May, while from the middle of June until frost the water plants are the main attraction. Plants in flower May 27 included: *Geranium sanguineum*, *Myosotis scorpioides*, columbines, pansies, *Veronica repens*, *Linaria Cymbalaria* (Kenilworth ivy), *Dicentra eximia*, *Geum* "Mrs. Bradshaw," *Helianthemum Chamaecistus* var. *mutabile*, *Armeria vulgaris* var. *splendens*, dianthus in variety, *Filipendula hexapetala (Spiraea Filipendula)*, and delphiniums. Other plants not in bloom were primulas, phlox in variety, blood-root, trilliums, thalictrums, stocks, violets, *Campanula carpatica*, sedums in variety, *Festuca ovina* var. *glauca*, *Cerastium tomentosum*, and three clumps of *Daphne Cneorum* which have passed through the winter in fine condition.

Mark C. Steinberg, Warson Road, Clayton (pl. 21).—One of the largest rock gardens in St. Louis County is under construction on the Steinberg estate. It parallels the Warson Road for 1000 feet and is 100 feet in width, with at least a hundred-foot slope toward the north, occupying an ideal location for a rock garden. It was started during the latter part of 1928, and the greater part of the rock work is now completed. Upwards of 500 tons of rock, including massive boulders in proportion to the size of the garden, have been hauled in from the Ozark region. At the highest point, or south end, a pool thirty feet in diameter is planted with tropical waterlilies; this flows through the valley into a series of smaller pools and cascades crossed by natural bridges. The large boulders permit the free use of dwarf and procumbent evergreens on the glades, and native cedars, dogwoods, red woods, and hawthorns form the boundary plantation between the garden and the Warson Road. Both slopes are built to represent a natural series of irregular glades and ledges. Most of the

planting so far consists of large perennials, such as iris, peonies, foxgloves, veronicas, lupines, tritomas, and gaillardias. Plants noted in flower on May 15 included: sedums in variety, dianthus in variety, iris, *Delphinium grandiflorum* var. *chinense*, veronicas, *Lychnis Viscaria* var. *splendens*, aubrietias, *Geum* "Mrs. Bradshaw," *Linum flavum*, *L. perenne*, *Silene acaulis*, columbines, *Armeria maritima*, gaillardias, foxgloves, *Lupinus polyphyllus*, dicentras, pyrethrums, and tritomas. When fully planted this rockery will contain thousands of plants and will be a mass of color.

E. M. Funsten, Hampton Park, Clayton (pl. 22).—This rock garden is entirely screened from the roadway by the residence to the north of it. The slope of the ground is from south to northeast, presenting an eastern exposure. A small waterfall flows from an upper into a lower pool, around which rocks are artistically arranged leading up to the ledge behind. Entering from the east one is immediately attracted by this ledge which is filled with sedums, dianthus, phacelias, and phlox.

The garden was built during 1927 and is planted mainly with native material brought in from the woods. Missouri ferns are well represented, especially north and west of the residence. Plants observed in flower on May 15 included: dianthus in variety, sedums in variety, *Tradescantia virginica*, monarda in variety, iris, columbines, myosotis, phacelias, armerias, geraniums, phlox in variety, *Chrysanthemum Leucanthemum*, *Verbena canadensis*, *Ranunculus repens*, veronicas in variety.

F. A. Brickenkamp, 64 Fair Oaks, Clayton (pl. 23).—As an illustration of the possibilities of a rock garden in a limited area, this is a very good example. It is built in the corner of the garden for the purpose of hiding the unsightly bare wall of a garage. Small procumbent junipers are used to advantage, and the smaller rock pockets are planted with sedums, arabis, dianthus, etc. An interesting cascade with a miniature pool gives added beauty to this artistic little garden.

G. H. P.
P. A. K.

GARDEN OF E. M. FUNSTEN, HAMPTON PARK, CLAYTON

GARDEN OF F. A. BRICKENKAMP, CLAYTON

GRAY SUMMIT EXTENSION, THE HOME OF A WEALTH OF WILD FLOWERS

The sixteen-hundred-acre tract belonging to the Garden, at Gray Summit, Mo., comprises practically every possible soil condition, with the natural result of a great variety of wild flowers. Among the types of situation may be mentioned limestone glades, open fields, shaded and partly shaded hillsides and rich woodlands, river-bottom land, sand bars, ravines, lake shores, limestone cliffs, sandstone outcroppings, and swamp land.

The one hundred wild flowers and ferns in the following list were collected on this tract on May 9, 1930, all in flower. The greatest number to be collected at any one time at Gray Summit was a hundred and seventeen, in June, 1928. Owing to the exceedingly dry weather that prevailed throughout April and May of this year, there was not the abundance of wild flowers found in former years, especially the year 1928. Due to the opposite reason, an excessive rainfall, there was also a scarcity in 1929. The rainfall during the middle of May, 1930, has done much to increase their blooming, especially the purple cone-flower (*Brauneria angustifolia* (DC.) Heller), tickseed (*Coreopsis lanceolata* L. and *C. lanceolata* (L.) var. *villosa* Michx.), Missouri primrose (*Oenothera missouriensis* Sims), and others, found especially on the limestone glades.

1. Nodding chickweed (*Cerastium nutans* Raf.)
2. Corn speedwell (*Veronica arvensis* L.)
3. Common yarrow (*Achillea Millefolium* L.)
4. Slender plantain (*Plantago elongata* Pursh)
5. Carolina cranesbill (*Geranium carolinianum* L.)
6. Shepherd's purse (*Capsella Bursa-pastoris* (L.) Medic.)
7. White clover (*Trifolium repens* L.)
8. Red clover (*Trifolium pratense* L.)
9. Daisy fleabane (*Erigeron ramosus* (Walt.) BSP.)
10. White top (*Erigeron annuus* (L.) Pers.)
11. Philadelphia fleabane (*Erigeron philadelphicus* L.)
12. Little barley (*Hordeum pusillum* Nutt.)
13. Wild strawberry (*Fragaria virginiana* Duchesne)
14. Spring avens (*Geum vernum* (Raf.) T. & G.)
15. Sheep sorrel (*Rumex Acetosella* L.)
16. Pale dock (*Rumex altissimus* Wood.)

17. Violet wood-sorrel *(Oxalis violacea* (L.) Pers.)
18. Yellow wood-sorrel *(Oxalis stricta* L.)
19. Gray beard-tongue *(Pentstemon canescens* Britton)
20. Common cinquefoil *(Potentilla canadensis* L.)
21. Blue phlox *(Phlox divaricata* L.)
22. Yellow sweet clover *(Melilotus officinalis* (L.) Lam.)
23. Dewberry *(Rubus villosus* Ait.)
24. Pursh's phacelia *(Phacelia Purshii* Buckley)
25. Cleavers *(Galium Aparine* L.)
26. Pellitory *(Parietaria pennsylvanica* Muhl.)
27. Virginia rock-cress *(Arabis virginica* (L.) Trel.)
28. Field scorpion-grass *(Myosotis arvensis* (L.) Hill)
29. Sleepy catchfly *(Silene antirrhina* L.)
30. Sandwort *(Arenaria patula* Michx.)
31. Sickle-pod *(Arabis canadensis* L.)
32. Wild ginger *(Asarum canadense* L.)
33. True Solomon's seal *(Polygonatum commutatum* (R. &. S.) Dietr.)
34. Jack-in-the-pulpit *(Arisaema triphyllum* (L.) Schott)
35. Green dragon *(Arisaema Dracontium* (L.) Schott)
36. Dwarf larkspur *(Delphinium tricorne* Michx.)
37. Carolina larkspur *(Delphinium azureum* Michx.)
38. Four-leaved milkweed *(Asclepias quadrifolia* Jacq.)
39. Wild comfrey *(Cynoglossum virginianum* L.)
40. Virginia goat's-beard *(Krigia amplexicaulis* Nutt.)
41. Rue anemone *(Anemonella thalictroides* (L.) Spach)
42. Scarlet-fruited horse-gentian *(Triosteum aurantiacum* Bicknell)
43. Green violet *(Hybanthus concolor* (Forster) Spreng.)
44. Spreading chervil *(Chaerophyllum procumbens* (L.) Crantz)
45. Spring beauty *(Claytonia virginica* L.)
46. Nyctelea *(Ellisia Nyctelea* L.)
47. Beet corn salad *(Valerianella radiata* (L.) Dufr.)
48. Hairy sweet cicely *(Osmorhiza Claytoni* (Michx.) Clarke)
49. Smooth sweet cicely *(Osmorhiza longistylis* (Torr.) DC.)
50. Cow parsnip *(Heracleum lanatum* Michx.)
51. Ground ivy *(Nepeta hederacea* (L.) Trevisan)
52. High-bush blackberry *(Rubus alleghcniensis* Porter)
53. White violet *(Viola striata* Ait.)
54. Bird-foot violet *(Viola pedata* L.)
55. Bi-colored bird-foot violet *(Viola pedata* (L.) var. *bicolor* Pursh)
56. Marsh blue violet *(Viola cucullata* Ait.)
57. Purple meadow parsnip *(Thaspium aureum* Nutt.)
58. Appendaged waterleaf *(Hydrophyllum appendiculatum* Michx.)
59. White dwarf plantain *(Plantago virginica* L.)
60. Small skullcap *(Scutellaria parvula* Michx.)
61. Nuttall's prairie parsley *(Polytaenia Nuttallii* DC.)
62. Oblong-leaved milkweed *(Asclepiodora viridis* (Walt.) Gray)
63. Shooting star *(Dodecatheon Meadia* L.)

64. Flowering spurge *(Euphorbia corollata* L.)
65. Tinted spurge *(Euphorbia commutata* Engelm.)
66. Hairy lance-leaved tickseed *(Coreopsis lanceolata* (L.) var. *villosa* Michx.)
67. Bradbury's monarda *(Monarda Bradburiana* Beck)
68. Creeping parthenium *(Parthenium repens* Eggert)
69. Long-leaved houstonia *(Houstonia longifolia* Gaertn.)
70. Golden Alexanders *(Zizia aurea* (L.) Koch)
71. Amsonia *(Amsonia Tabernaemontana* Walt.)
72. Hoary puccoon *(Lithospermum canescens* (Michx.) Lehm.)
73. Yellow pimpernel *(Taenidia integerrima* (L.) Drude)
74. Clustered snakeroot *(Sanicula gregaria* Bicknell)
75. Short-styled snakeroot *(Sanicula canadensis* L.)
76. Wild cranesbill *(Geranium maculatum* L.)
77. Rattlesnake fern *(Botrychium virginianum* (L.) Sw.)
78. Larger yellow lady's slipper *(Cypripedium parviflorum* (Salisb.) var. *pubescens* (Willd.) Knight)
79. False Solomon's seal *(Smilacina racemosa* (L.) Defs.)
80. Smooth rock-cress *(Arabis laevigata* (Muhl.) Poir.)
81. True water-cress *(Radicula Nasturtium-aquaticum* (L.) Britten & Rendle)
82. Common lousewort *(Pedicularis canadensis* L.)
83. Hispid buttercup *(Ranunculus hispidus* Michx.)
84. Hooked crowfoot *(Ranunculus recurvatus* Poir.)
85. Pointed blue-eyed grass *(Sisyrinchium angustifolium* Mill.)
86. Star grass *(Hypoxis hirsuta* (L.) Coville)
87. Missouri primrose *(Oenothera missouriensis* Sims)
88. Sessile-flowered wake-robin *(Trillium sessile* L.)
89. Green wake-robin *(Trillium viride* Beck)
90. Prairie wake-robin *(Trillium recurvatum* Beck)
91. Spiderwort *(Tradescantia virginiana* L.)
92. Ox-eye daisy *(Chrysanthemum Leucanthemum* L.)
93. Golden corydalis *(Corydalis aurea* Willd.)
94. Fremont's clematis *(Clematis Fremontii* Wats.)
95. Prairie ragwort *(Senecio plattensis* Nutt.)
96. Golden ragwort *(Senecio aureus* L.)
97. Greek valerian *(Polemonium reptans* L.)
98. Purple rocket *(Iodanthus pinnatifidus* (Michx.) Steud.)
99. Common winter-cress *(Barbarea vulgaris* R. Br.)
100. Robin's plantain *(Erigeron pulchellus* Michx.)

A. H. Jr.
J. H. K.

NOTES

The group of physicians attending the clinical conference of the St. Louis Clinics, held in St. Louis, June 9-21, visited the Garden, June 14.

Mr. G. H. Pring, Superintendent of the Garden, spoke at St. Peter's Evangelical Church, May 21, on "Orchid Exploration in Central and South America."

Mr. G. H. Pring acted as judge at the ninth annual garden show of the Associated Garden Clubs of Kirkwood, May 24.

The Kirkwood Garden Club No. 2 visited the Gray Summit Extension, May 16, accompanied by Mr. L. P. Jensen, Arboriculturist, and Mr. Anton Hogstad, Jr., Pharmacognosist to the Garden.

Dr. George T. Moore, Director of the Garden, spoke on "Movement in Plants" before the American Electro-Chemical Society, at the Coronado Hotel, May 30. The lecture was illustrated with moving pictures.

Dr. George T. Moore is the author of an article in the June "Junior League Magazine" on botanical gardens in general and the Missouri Botanical Garden in particular, under the title "The Greatest of Human Pleasures."

Mr. Anton Hogstad, Jr., Pharmacognosist to the Garden, has been selected by the "American Druggist" to represent that paper on the program of a model pharmaceutical convention for the state of Texas, held at Houston the week of June 16.

In the series of radio talks given by the Community Forum of the Community Fund Council over station KMOX, May 25, on "What Hobby Should I Choose," was an address by Dr. George T. Moore, Director of the Garden, on "The Hobby of Gardening."

Mr. Anton Hogstad, Jr., Pharmacognosist to the Garden, lectured before the Colloidal Medical Seminar, May 21, on "The Modern Atom;" and spoke on "The Romance of Drugs," May 23, before the teachers of biological sciences of the St. Louis schools, and June 12, before the South Side Lions Club.

Recent visitors to the Garden include Mr. A. C. Hottes, assistant editor of "Better Homes and Gardens"; Dr. Ella M. Martin, professor of biology, North Carolina College for Women, Greensboro, North Carlina; and Dr. R. H. Compton, director of the National Botanic Gardens of South Africa, who spent a day also at the Gray Summit Extension.

Mr. G. H. Pring, Superintendent of the Garden, gave two talks at the Missouri School for the Blind, before the Teachers' Institute, a summer course for the home teachers of the Missouri Commission for the Blind, June 11, on "Horticulture," and June 12, on "Floriculture." On June 19 he spoke before the South Side Lions Club on "Plant Curiosities."

Dr. Edgar Anderson, Geneticist to the Garden, on a year's leave to study at the John Innes Horticultural Institution, Merton, England, spoke before the Boys' League of Nations Club of the Mill Hill School, May 11, on "Camping in America." It will be recalled that Mill Hill School was the school which Henry Shaw attended in his boyhood. Dr. Anderson addressed the Genetics Club of Cambridge University, May 12, on "Biological Factors Affecting Speciation." He has recently made trips to the Universities of Glasgow and Edinburgh, spending considerable time in the botanical garden of the latter institution.

STATISTICAL INFORMATION FOR MAY, 1930

GARDEN ATTENDANCE:

Total number of visitors..... 35,206

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought..... 47
Total number of books and pamphlets donated..... 180

PLANT ACCESSIONS:

Total number of plants and seed packets donated..... 190
Total number of plants and seed packets purchased..... 3,645

PLANT DISTRIBUTION:

Total number of plants distributed in exchange..... 25

HERBARIUM ACCESSIONS:

By Purchase—

Bush, B. F.—Plants of Missouri..... 62
Donat, Dr. A.—Plants of Patagonia..... 100
Lundell, C. L.—Plants of British Honduras..... 159

By Gift—

Cottam, W. P.—Specimens of Umbelliferae..... 6
Featherley, H. I.—Plants of Oklahoma..... 2
Graham, E. H.—Plants of British Guiana..... 2
Tallman, Roscoe—*Oenothera missouriensis* Sims from Missouri 1
von Schrenk, Dr. H.—*Harpullia arborea* (Blanco) Radlk. from horticulture 1

By Exchange—

Hicks, Lawrence E.—Lemnaceae of Ohio..... 7
U. S. National Museum, by Dr. William R. Maxon—Myxomycetes from the Lloyd collection..... 17
University of California, by Prof. E. B. Copeland—Miscellaneous herbarium duplicates..... 133
University of Montana, by Miss Esther Larsen—*Plectritis macroptera* (Suksd.) Rydb. from Montana..... 1

Total 491

FLORAL DISPLAYS OF SPECIAL INTEREST IN 1930

In order that readers of the BULLETIN may have a more comprehensive idea of the various flower shows and outdoor exhibits which from month to month may be seen at the Garden, the following tentative schedule is given. While the indoor exhibits can be quite definitely indicated, the blooming period of outdoor plants is subject to variation, depending upon the weather, and out-of-town readers should confirm the date of any display before visiting the Garden.

JANUARY

(Floral Display House)
Orchids, Primroses, and Cyclamen.

FEBRUARY

(Floral Display House)
First half month—Orchids.
Second half month—Cinerarias.

MARCH

(Floral Display House)
March 1-17—Bulb Show.
March 20-23—St. Louis Florists' Show.
March 29—Azalea Show.

APRIL

(Floral Display House)
Azaleas, Roses, Schizanthus.
(Outdoors)
Pansies, English Daisies, Early-flowering Shrubs.

MAY

(Floral Display House)
Hybrid Pelargoniums, Salpiglossis, Begonias, Marguerites, Lupines, and other spring annuals.
(Outdoors)
Bulbs (early in month), Hardy Water-lilies, Peonies.
Iris (late in month), Spring-flowering shrubs and perennials.

JUNE

(Outdoors)
Roses, Hollyhocks. Medicinal Garden.

JULY

(Outdoors)
Tropical plants. Annuals. Economic Garden—farm crops, fiber plants, rice, cotton, peanuts, tobacco, sugar-cane. Medicinal Garden.

AUGUST

(Outdoors)
Tropical Water-lilies, Victoria Cruziana, Lotus lilies. Economic Garden. Medicinal Garden.

SEPTEMBER

(Outdoors)
Tropical Water-lilies. Economic Garden. Medicinal Garden.

OCTOBER

(Floral Display House)
Dahlia (novelties and newer varieties).

NOVEMBER

(Floral Display House)
Chrysanthemum Show.

DECEMBER

(Floral Display House)
Poinsettias, Stevias.

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove avenue and Flora place, on the Sarah car line (No. 42). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motorbus lines transfer.

STAFF
OF THE MISSOURI BOTANICAL GARDEN

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Director

KATHERINE H. LEIGH,
Assistant to the Director

HERMANN VON SCHRENK,
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Pharmacognosist

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H. VALLENTINE,
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GRAY SUMMIT EXTENSION

L. P. JENSEN,
Arboriculturist

D. MILLER,
Orchids

G. GOEDEKE,
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R. E. KISSECK,
Engineer

TROPICAL STATION, BALBOA, CANAL ZONE

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Manager

REPRESENTATIVE IN EUROPE

GURNEY WILSON, F. L. S.

Missouri Botanical Garden Bulletin

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CONTENTS

	Page
The Early Days of "Mr. Shaw's Garden"	119
Glad-e-o'-luss or Glad-eye'-o-luss?	122
The Trailing Ground Pine Found for the First Time in Missouri	125
An Excellent Decorative Plant for Open Ditches	126
Wild Flowers at the Gray Summit Extension	126
Notes	128
Statistical Information	129
Floral Displays of Special Interest in 1930	

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PLATE 24

VIEW OF SOUTH PORTION OF GARDEN, AND VICINITY

(From "Pictorial St. Louis, the great metropolis of the Mississippi Valley, a topographical survey drawn in perspective, A. D. 1875, by Camille N. Day, designed and edited by Rich. J. Compton, 1876.")

Missouri Botanical Garden Bulletin

Vol. XVIII SEPTEMBER, 1930 No. 7

THE EARLY DAYS OF "MR. SHAW'S GARDEN"

Because of the developments which have taken place since the death of Henry Shaw, one is apt to lose sight of the unique position held by his garden during the lifetime of its founder. An old number of "The Gardener's Monthly and Horticultural Advertiser", edited by Thomas Meehan and published in Philadelphia, was recently presented to the Garden library by Dr. William C. Wilson, of St. Charles, Mo. This number, which appeared in August, 1868, contains an interesting account of the Garden as it was sixty years ago. Because of the light it throws upon the outstanding position of "Mr. Shaw's Garden" at that time, as well as certain information relative to the content of the Garden in its early days, it is printed herewith in full:

THE BOTANIC GARDEN, ST. LOUIS, MO.

Mr. Henry Shaw is one of those liberal public spirited men who do so much honor to the United States. Some take pride in endowing and establishing one kind of institution, some others. Mr. Shaw's taste leads him to botany, arboriculture, and gardening. His Botanic Garden and residence at Tower Grove is unequalled by anything of the kind in the United States, and indeed by few others in the world. A substantial and handsome stone wall, with an imposing arched entrance, encloses the garden proper. This enclosed area is divided into suitable compartments, for the systematic arrangement of herbaceous and other plants of low growth. An architectural flower garden, sunk somewhat below the general level,

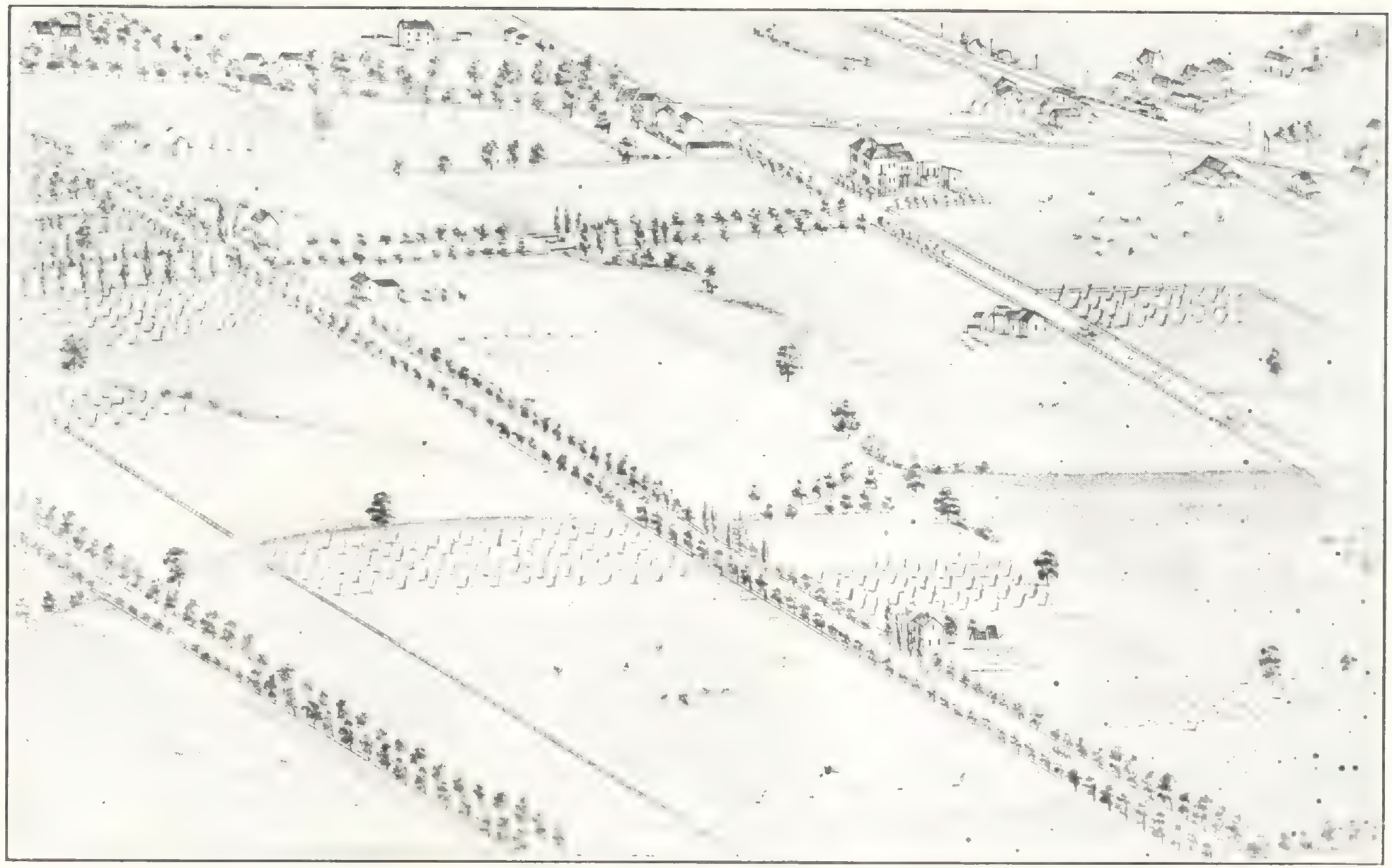
and surrounded by a grass terrace formed an attractive point. There is also within this main enclosure a portion of ground which has been set apart for a Fruticetum, or general collection of all hardy fruit-bearing trees; this will be of much interest, and has already been enriched by a considerable number of plants.

An Arboretum is also commenced, a field of thirty acres having been appropriated for the purpose, and a finer opportunity for displaying the relative beauties and peculiarities of trees could not be desired. The soil is rich prairie-loam, well adapted to tree growth, and the ground is sufficiently elevated and undulating to insure drainage; an injurious retention of moisture during winter months being the greatest attending evils of these rich soils.

The hot-house department is quite extensive, and the various collections are gradually being filled up. A new palm or tropical house on a magnificent scale was being constructed. The acacia and cactus families are so far the most extensive, although, of course, very far from being complete; there are also quite a number of palms and numerous miscellaneous plants, all in robust health, clean and kept in the finest condition. One of the hot-houses is built with a ridge and furrow roof, a style seldom adopted now on a single slope or lean-to house, although its only objection is probably that of cost; houses so built are as suitable for plant structures as any other.

A noticeable improvement is a large building of elegant proportions, which is to be devoted to the purpose of a Museum of Botany. The interior fittings are being finished in an elaborate manner. The ceiling of the principal room is enriched by emblematic frescoes, and the names of Linnæus, Jussieu, Endlicher, De Candolle, Brown, Hooker, Lindley, Gray and Engelmann, are placed in conspicuous niches. The Herbarium already embraces forty thousand specimens, and is constantly receiving additions.

The whole of this beautiful place is thrown open freely to the public every day in the week, and the greatest pleasure of the liberal proprietor is to see how freely the public enjoy themselves, and to reflect on the immense power which such refined influences have on the general happiness of mankind. It is difficult indeed to form an estimate of the full value of such liberality. Thousands here have created in them the first germs of usefulness which operate in so many ways. In Botany already the whole world looks to St. Louis. The name of Engelmann is honored wherever Botany thrives; and we believe we violate no confidence in saying, that the name of Shaw, Engelmann, and the Botanic garden will go down into history together. A rather sad but yet interesting feature of the ground was the lots set apart for the future resting place of Mr. Shaw and Dr. Engelmann. It was sad to reflect that the noblest minds amongst humanity, whose whole lives are devoted to the happiness of their fellow men, and the development of science to which we all owe half the comforts and pleasures of the present age, received no more consideration from the hands of death than



VIEW OF NORTH PORTION OF GARDEN, AND VICINITY

(From "Pictorial St. Louis, the great metropolis of the Mississippi Valley, a topographical survey drawn in perspective, A. D. 1875, by Camille N. Day, designed and edited by Rich. J. Compton, 1876.")

the meanest and most useless; yet it was comforting to feel that death does not destroy the work of such men. A man's identity after all is his character. This never dies. And though this lovely spot may contain the ashes of these men, they will live in the hearts of thousands for generations yet to come.

Mr. Shaw's benevolence has not rested with these gardens, which are mainly for the purpose of gardening and science. He has donated a large tract of very valuable land to the city for the purpose of a public park and drive, on condition that the city appropriate a large sum of money for its immediate improvement. We see since our return, by the St. Louis papers, that this has been accepted, and we may soon hear of St. Louis having a lovely spot to boast of, of which a New Yorker might be proud.

Another interesting account has been received through the kindness of Mr. and Mrs. George O. Carpenter. It was found among a collection of old newspaper clippings and sent to them by a friend. Although there is no indication as to the paper from which it came or the date, it must have appeared about 1859 or 1860:

GREAT WORK—THE JARDIN DES PLANTES OF THE UNITED STATES

A few days since we visited for the first time the estate and private grounds of Henry Shaw, Esq. We doubt whether one in a hundred of the residents of St. Louis know of the immense work laid out by this gentleman, for the benefit not only of St. Louis—within whose borders it will be—but of the whole United States, and especially that portion west of the Alleghany mountains. Here is a man who, relinquishing, at the age men generally become craving, all desire for further accumulation of wealth, has studied how best he can appropriate the fortune of which he has been the artificer, to the best interest of his fellow-beings. Here we find a man, who, taking a broad, common sense view of things, sees that so long as man exists, the pursuit of agriculture must be the leading one of the majority, and that to create an endurable existence of matter, enuring to its interests, he is creating one which has in its object the greatest good to the greatest number. Here, then, right in our midst, and unknown by but few, for such men never blazon their acts, is a man devoting his time, his talents and his purse to the creation of a complete arboretum of all the known plants, trees or shrubs in existence, and having as one of its continuing objects the reproduction and improvement of sundry plants, trees, fruits, etc., etc., by aid of scientific skill and its abettors.

Here is a man who, instead of parcelling out his lands, and selling them by the foot, to see how many dollars he can count as his deposit in bank, prefers rather to devote not only this land, but with

it his time and other means to the establishment of an immense public garden and museum, destined as a gift to our city.

Already have ten acres been prepared by first thoroughly and deeply trenching it, laying in main and intersecting drains, and enclosing the same with a wall that will stand as long as the native rocks. At this time the entrance gate-way or lodge is being constructed—it is of massive, yet architectural proportions, laid with limestone and perfectly cemented. The joiner work of the plant houses is also going on, and it is designed to have this ten acres, which is to be devoted exclusively to plants and vines, completed this fall. Another year will probably see it filling up with plants arranged in reference to their botanical affinity.—From year to year the work is to be pushed forward as rapidly as is consistent with true arrangement until the fruticetum, pinetum, etc., etc., are complete.

An immense building for the purpose of a museum, and for lecture halls, is also to be erected. Professors are to be engaged and supported from a fund or revenue accruing from rent of lands outside, and classes of students are to be instructed in all the branches requisite to their pursuance in practice of any and everything relating to agriculture, horticulture or floriculture.

With all the care of planning and superintending the prosecution of this great work, Mr. Shaw finds time to see that his grape houses, plant houses, and private gardens, are kept in perfect order and neatness. In his glass structures, we observed many of the best known sorts of foreign grapes, with large and full branches, having the fruit well filled out, and generally promising to mature perfectly. In one house we saw a wall of some fourteen by forty feet, perfectly covered with fig trees, trained *en Enspalier*. They had made vigorous and healthy growth, and if root-pruned at the right time, as undoubtedly they will be, they will set a splendid crop of fruit another year. Pine apples, lemons, etc., were ripening up, and the whole appearance of the house plants can only be excelled by the luxuriance of vegetation among hardy tree and shrub, in fruit or flower border out of doors.

GLAD-E-O'-LUSS OR GLAD-EYE'-O-LUSS?

As is well known, all plants which have been described are given a Latin name consisting of two or three words. The first indicates the genus or group under the family to which the plant belongs. The second is the specific name applied to the kind of plant in question, and this may be followed by a third or varietal name which indicates some slight difference not regarded as sufficiently distinct to warrant its being named as a new species. Thus while there can be but

one *genus* name, there may be many *species* names under a genus.

In the Lily family (Liliaceae), for instance, there are some twelve or fourteen genera found in the United States. One of these, the common wild onion, belongs to the genus Allium, and to distinguish it from the wild garlic and seven or eight other alliums it is called *Allium cernuum*. It is as though the Smith family were divided into groups (or genera) according to the color of hair, eyes, etc., and those dark-skinned red-haired individuals were given a name such as Rhodomela (red-black). Then a specific or Christian name of John or Helen would be added to describe the individual. In plants, of course, there is no duplication of specific names under a given genus. So in the Smith family, following the same system, there could be only one John Rhodomela (or Rhodomela John as the plants have it), although there might be other Johns in other groups.

The advantage of a Latin name is that it can be universally employed and will indicate to a student of plants, in whatever country he may live or whatever language he speaks, the precise plant meant. Many plants, but not all, have in addition a common name by which they are known locally. The average gardener is usually satisfied if he can call his flowers by the English name that was known to his mother or that he has learned from a seed catalogue. However, the common name he uses may mean something quite different to his neighbor and is almost certain to mean something else in another country. In Missouri the blue-bell generally denotes Mertensia, in Scotland it is the Campanula, and in England Scilla. There are some twenty or thirty other plants which go under the local name of "blue-bell" in different parts of the world.

This may seem a long preamble to a discussion of the correct pronunciation of Gladiolus, but it is essential that the distinction between the Latin name and the common name be clear, for this is where the confusion has arisen. It so happens that the common name for Gladiolus has been adopted directly, without change of spelling, from the Latin name, and it all depends upon whether one is talking about the

genus Gladiolus or the flower growing in the garden. The preferred pronunciation of the *genus* is Glad-eyé-o-luss, although one authority maintains that Terence (born 190 B. C.) would have said Glad-e-ó-lus. In Latin all vowels are usually short (i as in pin). But if one is using the name as a *common* or *English* name, as one would say "dandelion" or "honeysuckle," there is certainly no point to giving the Latin pronunciation. In other words, the Latin name is pronounced Glad-eyé-o-luss, the common or English name Glad-e-ó-lus. The dictionaries are about equally divided, some favoring Glad-i-ó-lus, and others Glad-í-o-lus. It is difficult to tell, however, whether the pronunciation of the Latin or common name is meant. In most cases the pronunciation is evidently for the Latin name, which of course should be Glad-í-o-lus. If the spelling were not the same for both the Latin and common names there would probably have been no difficulty. The genus name for the rose is Rosa, and consequently there has never arisen any confusion as to the correct pronunciation of the common name.

Botanists themselves are far from consistent in pronouncing the Latin names of plants. Usually the pronunciation is handed down by oral tradition from the men with whom they have studied. In fact, the few botanists who pronounce plant names according to the fixed rules of Latin grammar are frequently understood with difficulty by their fellow workers.

Another good example of the difference in the pronunciation of the Latin and common name is to be found in that of the widely distributed "wind-flower" or anemone. The Latin name of the genus is pronounced an-e-mó-ne, but if one called our graceful wild flower anything but a-nem′-o-ne, it is doubtful if those to whom he was talking would know what was meant. Another plant name about which there is confusion is the vine Wisteria. Those who make a pretense of speaking accurately take great delight in saying Wist*a*ria and do not hesitate to correct any one using an "e" for an "a". They have been told, no doubt, that the plant was named in honor of Caspar Wistar, professor of anatomy at the University of Pennsylvania, and it seems natural enough to say Wist*a*ria. However, it so happens that Nuttall, who originally gave the

name, wrote Wist*e*ria and the change to Wist*a*ria came later, presumably by some one who thought he knew better. Surely the author of the genus knew what he was doing; in any case the name given by him should stand.

On the other hand, it sometimes is quite necessary to know the name of the man for whom the plant was called. The dahlia was named in honor of the Swedish botanist, Andrew Dahl. Consequently the pronunciation usually heard in America is correct. In England the impression seems to have been that the plant was named for Dr. Dale, a botanist of the old Chelsea Physic Garden, hence the "day-lia" frequently heard in Great Britain.

THE TRAILING GROUND PINE FOUND FOR THE FIRST TIME IN MISSOURI

A recent botanical trip to Pickle Spring in Ste. Genevieve County by Mr. John H. Kellogg revealed for the first time the fact that, so far as known, the trailing ground pine (*Lycopodium complanatum* L.) grows in Missouri. It was found on dry sandstone ledges among pines and azaleas. Although called "trailing ground pine" it is not a pine and does not creep over the ground. It is the creeping nature of the rootstock, which is superficial and rather widespread, that gives it the name of "trailing." Because it is evergreen it is sometimes popularly called "trailing Christmas green." The group to which Lycopodium belongs is commonly termed "club moss," although, as a matter of fact, it is not a moss but belongs to the same group as the fern. This makes the third club moss found growing in Missouri, the other two being *Lycopodium lucidulum* (Michx.), collected at Hog Hollow, and *Lycopodium lucidulum* var. *porophilum* (Lloyd & Underw.) Clute, collected at Pickle Spring. Aside from its use as Christmas greens, the spores of the common club moss (*Lycopodium clavatum* Linn.) have been used in the manufacture of flashlight powder and for causing the flare in flambeaus, as well as a dusting powder in pharmacy.

AN EXCELLENT DECORATIVE PLANT FOR OPEN DITCHES

During the course of the past two years numerous persons have made inquiry concerning the decorative plant in the ditches which connect the several pools in the medicinal plant garden, directly west of the Italian garden. The plant used here is the creeping buttercup (*Ranunculus repens* L.), found in the vicinity of St. Louis in wet meadows, fields, and roadside ditches. It was probably introduced from Europe but is now indigenous to middle and western United States. It is a perennial and a rapid grower, and when placed in the crevices of rocks in a walled-in ditch completely fills the ditch and covers the rocks the first year. The plant is characterized by green and white variegated or spotted leaves, and an abundance of showy yellow flowers.

WILD FLOWERS AT THE GRAY SUMMIT EXTENSION

The following 66 native plants, all in flower, were collected at the Garden Extension at Gray Summit, on August 20, 1930. After a period of extreme heat and drought lasting nearly five months, it seems remarkable that so many plants have been able to persist and to produce flowers, particularly those which are found growing in open fields and sunny rocky glades:

Abutilon Theophrasti Medic (Velvet leaf)
Asclepias verticillata L. (Whorled milkweed)
Cacalia reniformis Muhl. (Great Indian plantain)
Cacalia tuberosa Nutt. (Tuberous Indian plantain)
Campanula americana L. (Tall bellflower)
Cassia Chamaecrista L. (Partridge pea)
Cichorium Intybus L. (Chicory)
Cirsium altissimum (L.) Spreng. (Roadside thistle)
Cirsium lanceolatum (L.) Hill (Bull thistle)
Commelina virginica L. (Virginia day-flower)
Convolvulus arvensis L. (Field bindweed)
Croton glandulosus L. (Glandular croton)
Croton capitatus Michx. (Hogwort)
Cuphea petiolata (L.) Koehne (Clammy cuphea)
Datura Tatula L. (Purple thorn-apple)
Desmodium grandiflorum (Walt.) DC. (Pointed-leaved tick trefoil)
Dianthera americana L. (Water willow)

Eupatorium coelestinum L. (Mist flower)
Eupatorium serotinum Michx. (Late-flowering thoroughwort)
Euphorbia corollata L. (Flowering spurge)
Gaura biennis L. (Biennial gaura)
Gerardia tenuifolia Vahl (Slender gerardia)
Helenium nudiflorum Nutt. (Purple-head sneezeweed)
Helianthus annuus L. (Common sunflower)
Helianthus hirsutus Raf. (Stiff-haired sunflower)
Helianthus tuberosus L. (Jerusalem artichoke)
Houstonia angustifolia Michx. (Narrow-leaved houstonia)
Ipomoea pandurata (L.) G. F. W. Meyer (Wild potato vine)
Lactuca floridana (L.) Gaertn. (Florida lettuce)
Lespedeza Manniana Mackenzie & Bush (Mann's tick trefoil)
Lespedeza procumbens Michx. (Trailing bush clover)
Lythrum Salicaria L. (Simple loosestrife)
Lobelia siphilitica L. (Great blue lobelia)
Melilotus alba Desr. (Sweet clover)
Melilotus officinalis (L.) Lam. (Yellow sweet clover)
Mimulus alatus Ait. (Sharp-winged monkey flower)
Monarda fistulosa L. (Wild bergamot)
Oenothera biennis L. (Common evening primrose)
Oenothera serrulata Nutt. (Tooth-leaved evening primrose)
Oxalis corniculata L. (Lady's sorrel)
Physalis angulata L. (Cut-leaved ground cherry)
Physostegia virginiana (L.) Benth. (False dragon-head)
Phytolacca decandra L. (Pokeweed)
Polygonum aviculare L. (Knot-grass)
Polygonum hydropiperoides Michx. (Mild water pepper)
Polygonum lapathifolium L. (Pale persicaria)
Prunella vulgaris L. (Heal-all)
Pycnanthemum pilosum Nutt. (Hairy mountain mint)
Rudbeckia fulgida Ait. (Orange cone-flower)
Rudbeckia triloba L. (Thin-leaved cone-flower)
Ruellia strepens L. (Smooth ruellia)
Seymeria macrophylla Nutt. (Mullein foxglove)
Sida spinosa L. (Prickly sida)
Silphium integrifolium Michx. (Entire-leaved rosin-weed)
Silphium laciniatum L. (Compass plant)
Silphium perfoliatum L. (Cup plant)
Solanum nigrum L. (Common nightshade)
Solidago canadensis L. (Canada golden-rod)
Solidago ulmifolia Muhl. (Elm-leaved golden-rod)
Tecoma radicans (L.) Juss. (Trumpet creeper)
Teucrium canadense L. (American germander)
Verbena stricta Vent. (Hoary vervain)
Vernonia Baldwini Torr. (Baldwin's iron-weed)
Vernonia crinita Raf. (Great iron-weed)
Vernonia fasciculata Michx. (Western iron-weed)
Xanthium canadense Mill. (American cocklebur)

—L. P. J.

NOTES

Dr. David H. Linder, Mycologist to the Garden, lectured before the St. Louis Horticultural Society, September 5, on "Plant Exploration in British Guiana."

The July number of "Garden Life" contains an article by Mr. L. P. Jensen, Arboriculturist to the Garden, on "Native Plants for the Rock Garden."

Mr. G. H. Pring, Superintendent of the Garden, spoke at a luncheon of the South Side Kiwanis Club, at Bevo Mill, August 22, on "Plant Curiosities."

Mr. L. P. Jensen, Arboriculturist to the Garden, gave an illustrated lecture before the St. Louis Horticultural Society, August 1, on "Wild Flowers for the Garden."

Mr. Anton Hogstad, Jr., Pharmacognosist to the Garden, addressed the Nature Study group of the Chautauqua, Piasa, Illinois, July 16, on "Orientation of Man to Nature."

Dr. Edgar Anderson, Geneticist to the Garden, read a paper before the International Botanical Congress, at Cambridge, England, August 21, on "Internal Factors Affecting Discontinuity between Species."

The members of the St. Louis Horticultural Society were guests of the Garden at the Gray Summit Extension, June 7, when Mr. L. P. Jensen, Arboriculturist to the Garden, gave a talk on "The Gray Summit Extension."

Dr. Edgar Anderson, Geneticist to the Garden, who has been on leave of absence for a year to study at the John Innes Horticultural Institute, Merton, England, in collaboration with Miss H. Schafer of that institution, presented a paper and exhibit at the Conversazione of the Royal Society of London, at Burlington House, June 25, on "Interspecific Hybridization in Aquilegia."

Among those visiting the Garden library during the summer were: Dr. Ethel T. Eltinge, instructor in botany, Mt. Holyoke College, South Hadley, Mass.; Miss Catharine L. Lieneman, instructor in botany, North Carolina College for Women,

Greensboro, N. C.; Dr. C. C. Epling, instructor in botany, University of California at Los Angeles; Dr. H. M. Jennison, professor of botany, University of Tennessee; Dr. Baini Prashad, officiating director of the zoological survey of India and in charge of the zoological section of the Indian Museum in Calcutta; and Dr. C. E. Moore, head of biology department, State Teachers College, Memphis, Tenn.

STATISTICAL INFORMATION FOR JUNE-AUGUST, 1930

GARDEN ATTENDANCE:

Total number of visitors in June	**31,131**
Total number of visitors in July	**25,575**
Total number of visitors in August	**34,893**

PLANT ACCESSIONS:

Total number of plants and seed packets received as gifts in June	20
Total number of plants and seed packets received as gifts in July	32
Total number of plants and seed packets received as gifts in August	42

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought in June	30
Total number of books and pamphlets donated in June	105
Total number of books bought in July	17
Total number of books donated in July	17
Total number of books and pamphlets bought in August	88
Total number of books and pamphlets donated in August	179

FLORAL DISPLAYS OF SPECIAL INTEREST IN 1930

In order that readers of the BULLETIN may have a more comprehensive idea of the various flower shows and outdoor exhibits which from month to month may be seen at the Garden, the following tentative schedule is given. While the indoor exhibits can be quite definitely indicated, the blooming period of outdoor plants is subject to variation, depending upon the weather, and out-of-town readers should confirm the date of any display before visiting the Garden.

JANUARY

(Floral Display House)
Orchids, Primroses, and Cyclamen.

FEBRUARY

(Floral Display House)
First half month—Orchids.
Second half month—Cinerarias.

MARCH

(Floral Display House)
March 1-17—Bulb Show.
March 20-23—St. Louis Florists' Show.
March 29—Azalea Show.

APRIL

(Floral Display House)
Azaleas, Roses, Schizanthus.
(Outdoors)
Pansies, English Daisies, Early-flowering Shrubs.

MAY

(Floral Display House)
Hybrid Pelargoniums, Salpiglossis, Begonias, Marguerites, Lupines, and other spring annuals.
(Outdoors)
Bulbs (early in month), Hardy Water-lilies, Peonies.
Iris (late in month), Spring-flowering shrubs and perennials.

JUNE

(Outdoors)
Roses, Hollyhocks. Medicinal Garden.

JULY

(Outdoors)
Tropical plants. Annuals. Economic Garden — farm crops, fiber plants, rice, cotton, peanuts, tobacco, sugar-cane. Medicinal Garden.

AUGUST

(Outdoors)
Tropical Water-lilies, Victoria Cruziana, Lotus lilies. Economic Garden. Medicinal Garden.

SEPTEMBER

(Outdoors)
Tropical Water-lilies. Economic Garden. Medicinal Garden.

OCTOBER

(Floral Display House)
Dahlia (novelties and newer varieties).

NOVEMBER

(Floral Display House)
Chrysanthemum Show.

DECEMBER

(Floral Display House)
Poinsettias, Stevias.

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove avenue and Flora place, on the Sarah car line (No. 42). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motorbus lines transfer.

STAFF
OF THE MISSOURI BOTANICAL GARDEN

GEORGE T. MOORE,
Director

KATHERINE H. LEIGH,
Assistant to the Director

HERMANN VON SCHRENK,
Pathologist

DAVID H. LINDER,
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JESSE M. GREENMAN,
Curator of Herbarium
(On leave of absence)

ANTON HOGSTAD, JR.,
Pharmacognosist

ADELE L. GRANT,
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A. D. FORRESTER,
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A. PEARSON,
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H. VALLENTINE,
Carpenter

GRAY SUMMIT EXTENSION

L. P. JENSEN,
Arboriculturist

D. MILLER,
Orchids

G. GOEDEKE,
Farm

R. E. KISSECK,
Engineer

TROPICAL STATION, BALBOA, CANAL ZONE

A. A. HUNTER,
Manager

REPRESENTATIVE IN EUROPE

GURNEY WILSON, F. L. S.

Missouri Botanical Garden Bulletin

Vol. XVIII OCTOBER, 1930 No. 8

CONTENTS

	Page
Miniature Glass Gardens for the Home	131
Fashions in Flowers	135
The National Orchid Show	136
Notes	138
Statistical Information	140

Floral Displays of Special Interest in 1930

ST. LOUIS, MO.
1930

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President of The Academy of Science of St. Louis

ARTHUR A. BLUMEYER,
President of the Board of Education of St. Louis

DANIEL BRECK, Secretary

PLATE 26.

GLASS GARDEN TWO YEARS OLD

(Hardy primroses, bird's-foot violet, dwarf philodendron, dianthus, ceratostigma.)

Missouri Botanical Garden Bulletin

Vol. XVIII OCTOBER, 1930 No. 8

MINIATURE GLASS GARDENS FOR THE HOME

Although the Wardian case as a means of shipping plants successfully between widely separated countries has long been well known to both botanical and commercial institutions, it is only within comparatively recent years that miniature Wardian cases, or glass-enclosed gardens, for the home have become popular, or have seemed even feasible. The November, 1914, number of the BULLETIN contained an extensive article on the history, use, and construction of Wardian cases, and therefore only a short resumé will be given here.

Nearly a hundred years ago, Nathaniel Ward, a London physician, stumbled upon a method of raising and keeping plants in an environment supposedly quite unsuited to them. He had built for himself in his London garden a brick-walled corner and had carefully planted it with the mosses and ferns which he so earnestly desired to grow. Much to his distress the fog and smoke of London killed all his plants one by one. One day he discovered the cocoon of a sphinx moth, placed it in a large-mouthed glass bottle containing some rich damp loam, and covered it with a lid. Much to his surprise, within a few weeks a young fern and small grass plant made their appearance and continued to grow in the covered bottle. For nearly four years he kept these plants in the bottle and would have probably kept them indefinitely had the bottle not been accidentally destroyed.

Dr. Ward then began to experiment with many plants in

cases of various sizes and shapes until finally his invention found a very practical use in transporting plants between foreign countries. In those days of sailing vessels, when a voyage might last for eight months, especially when it involved crossing the equator, the transportation of plants was a difficult problem. They would die from cold, from heat, from lack of water, from gases in the hold of the ship, etc. In 1833 two cases were filled with plants and sent from England to Sidney, Australia, where they were emptied, refilled with other plants and sent back. The cases were kept on deck and the plants not once watered during the eight-months voyage, yet they arrived in perfectly healthy and vigorous condition. A letter from Captain Mallard, in charge of this ship, to Dr. Ward, concludes: "Allow me to offer you my warm congratulations upon the success of this simple but beautiful discovery for the preservation of plants in the living state upon the longest voyage; and I feel not a little pride in having been the instrument by which the truth of your new principle has been fully proved by experiment."

Elaborate instructions as to the making of small Wardian cases for the home have appeared in various publications during the past few years, but to the ordinary householder without the gift of carpentry, building the necessary wooden framework and fitting it with glass seems too great a task. Looking about for some easier method of bringing a bit of the summer woods indoors for the winter, Miss Ruth Barry, one of the most successful amateur gardeners in St. Louis, had the happy inspiration of building these small gardens in glass globes, thus eliminating the labor of construction, as well as reducing the expense so as to bring the gardens within reach of almost any one. After considerable experimentation the type of globe decided upon as producing the best results was a two-gallon clear-glass aquarium with two flat sides and a round hole at the top. Smaller sizes of the same type can of course be used, but then the difficulty of keeping the scale of the plants and finished garden down to that of a smaller bowl is hard to overcome. These bowls may be purchased at any department store or shop where goldfish are for sale. It should be borne in mind that the glass must

GLASS GARDEN SIX MONTHS OLD

(Red cedar, greenhouse ferns, and mosses.)

GLASS GARDEN ONE YEAR OLD
(Red cedar and club moss.)

be clear, since the plants will not flourish in bowls of tinted glass.

After cleaning and polishing the bowl, place a large handful of charcoal chunks in the bottom, to aid in keeping the soil "sweet." A handful of broken flower pots is then added and finally the soil. The mixture of soil usually advocated is one-third each of ordinary garden soil, leaf mold, and sand, and these proportions can very well be followed by those who do not have access to natural leaf mold from the woods. It has been found, however, that if the plants come from the woods (and these are on the whole the most successful) well-rotted leaf mold collected in the woods at the same time as the plants, combined with one-third sand, makes an ideal soil for the gardens. The soil should be saturated with water, that is, it should be so wet that when taken in the hands and placed in the bowl the water almost drips from it. Fill the bowl about one-third full of this soil, arranging it unevenly so as to give the effect of a natural woodland, with tiny hills and valleys. While putting in the soil quantities of green moss should be forced down the flat sides of the bowl, together with a few colored stones and shells, so that the sides will be attractive. This moss will continue to grow upward through the soil and give the appearance of a miniature forest.

Naturally the most important matter now is what plants to use and where to obtain them. Experience has taught that the best source of supply is our own native woods. It is not necessary to go far from the city to find a wealth of material admirably well suited for the purpose. A brookside leading from a spring which has not gone dry during the summer is a good collecting place. Gather quantities of soft green moss, all the varieties that can be found growing on soil, not on wood, the tiniest ferns that can be found, the smallest imaginable seedlings of spruce, pine, and cedar, none over three inches in height. Until you have made one of these gardens it is almost impossible to realize how very small the plants must be to conform to the scale of the finished garden. In case it is impossible to gather material in the woods, a successful garden may be made from such

plants as very small palm seedlings, snake grass, myrtella, selaginella, croton, green and white variegated pandanus, etc. Sprigs of box or barberry stuck in the soil will root and grow most effectively. In general, avoid plants with succulent leaves and stems, with the one exception of the common begonia. Rooted cuttings of begonia, which begin to bloom almost at once, add a pleasing touch of color to the small garden and if carefully watched will last a long time. Half the fun of these gardens, however, is the trip to the woods for material. As late as the middle of November, in small gulleys under fallen leaves, may be found quantities of baby ferns and fat hummocks of bright green moss to use in making the gardens for Christmas gifts.

After all the larger plants are arranged according to individual fancy and planted, the surface of the ground should be covered with as many varieties of moss as can be found and very small-leaved ground-cover plants. A few small boulder-shaped rocks, a shell or two, tiny Buddhas or dwarf figures may be used beneath the trees. Very small round mirrors, shellacked on the back to prevent penetration of moisture, make quite natural-appearing lakes. Ambitious makers of these gardens follow a definite landscape plan, with paths and pergolas and even miniature rock gardens.

When the garden is planted, carefully clean from the glass all smears of soil, place a flat glass plate on top as a lid and establish the bowl in a north window. It should never be placed in direct sunlight, since the intense heat created inside the closed bowl will injure the plants in an almost unbelievably short time. Keep the glass lid on the bowl almost constantly. The moisture observed on the inside of bowl and lid each morning will fall on the plants and be absorbed later in the day. Look at the garden each day, and if at any time mold is observed on the soil or plants, tip the lid to one side a trifle and leave it so for a half-day. Test the soil once in a while with the finger to see if it is moist, and if not, sprinkle very lightly with a fine spray of water. This should very seldom be necessary, however, since the moisture which naturally forms inside the bowl is sufficient for the plants. These gardens may be kept for many years

Mo. Bot. Gard. Bull., Vol. 18, 1930.

TWO MONTHS OLD TWO YEARS OLD

Greenhouse ferns, selaginella, and red cedars.

SELAGINELLA GROWN IN GLASS BOWL FOR ABOUT TWO YEARS

practically with the same contents as when started, though occasional replacements with smaller plants or fresh moss are sometimes desirable. Keeping the air free from soot, the temperature even, the moisture content constant, and the air quiet yet with sufficient ventilation, makes possible success with these gardens in the unfavorable environment of the average home. K. H. L.

FASHIONS IN FLOWERS

That there are fashions in flowers and landscape effects, as well as in architecture and in clothes, is easily proved by a glance into the back numbers of almost any magazine dealing with floriculture and so-called artistic planting. Just as large hats atop enormous pompadours, mutton-leg sleeves, and waspish waist lines are now objects of mirth, so do the pictures of elaborate plantations in the parks and gardens of forty years ago rouse ridicule at the peculiar taste that could have fancied such monstrosities, and just so perhaps will the knee-length dresses, bobbed hair, and rock gardens of this age affect the more erudite generation which is to follow us.

One of the most striking examples of the so-called "carpet bedding" of the eighties was that established in Washington Park, Chicago, in the summer of 1888. Mr. James M. Gurney, Jr., Superintendent of Tower Grove Park, found the old photograph (here reproduced), and it is to him that the BULLETIN is indebted for the information which forms the basis of this article. Mr. Kanst, of Chicago, now 83 years old, father-in-law of Mr. Gurney, was the author of this especially interesting bit of work, and without either defending or condemning the fashion of that day, he simply insists that "beauty is in the eye of the beholder" and lets the matter rest with that. Below is Mr. Gurney's explanation of the photograph:

"The planting pictured includes two row-boats, rowed from opposite directions toward the same goal, a large chair on the back of which grows the date '1888.' Seated in each boat is a man, literally implanted at the oars, and endowed with individual facial characteristics (likenesses were achieved by infinite detail work in the selection and shading

of plants used). Directly in back of the chair looms a floral post, on top of which sits an owl, presumably of the wise variety, and directly under the owl his immortal utterance, 'HOO,' asks it with plants.

"Now for the explanation: Cleveland and Harrison were the Democratic and Republican candidates for the Presidential chair that year, 1888, and Mr. Kanst indulged his notion of mixing politics with a bit of floral cartooning.

"At that time visitors to Chicago parks were greatly pleased with the apparent popularity of the floral fancies of carpet bedding. Whether it was worth doing (and no one can deny it was laborious work requiring skill when well executed) did not enter into the doing for this again was the fashion of the day, and thousands of succulents and dwarf plants were offered up or coaxed to embroider lawn areas in the prevailing style." K. H. L.

THE NATIONAL ORCHID SHOW

The fourth national exhibition of orchids given by the American Orchid Society was held in the ball-room of the Willard Hotel, Washington, D. C., October 16-18. The number of exhibitors, both private and commercial, exceeded that of past orchid shows, and the type of flowers showed that the orchid hybridist and enthusiast is striving for a higher standard in quality. Due to the show being held in October, instead of May as heretofore, the plants represented different genera from those formerly displayed at orchid shows. The greatest number of specimens were Cattleya species and hybrids, the number of Odontoglossums was limited, and there was an absence of Cymbidiums, Dendrobiums, Miltonias, and Phalaenopsis. A few rare plants of Vanda were seen, one specimen, *Vanda Lowii*, bearing three pendent spikes, four feet in length, with both staminate and pistillate flowers. The largest single-specimen orchid was *Cattleya Bowringiana*, bearing more than two hundred flowers of a deep mauve color. Despite the season, Paphiopedilum (Cypripedium) was well represented and showed the great strides made by hybridization in this genus, especially in increasing the size of the dorsal sepal. The Odontoglossum group was

CARPET BEDDING IN WASHINGTON PARK, CHICAGO, 1888

Mo. Bul. Gard. Bull., Vol. IX, 1923

awarded the first prize for the most artistic exhibit in the show, and *Cattleya* x "Mona" was given a prize for the best hybrid seedling of American origin not previously exhibited.

Missouri Botanical Garden Exhibit.—The Garden sent an exhibit illustrating the development of orchids from seed to the mature plant. One hundred Erlenmeyer flasks contained the seedlings in various stages of growth from two weeks to eight months old. A complete succession from this stage to the flowering plant was demonstrated by numerous potted plants from those in thimble-size pots to six-inch size. The symbiotic and asymbiotic methods of germination could be compared by examples of plants one and four months old. The various genera represented were: Cattleya, Laeliocattleya, Brassolaeliocattleya, Rolfeara, Potinera, Cymbidium, Dendrobium, Zygopetalum, Odontoglossum, Oncidium, Vanda, and Phalaenopsis. Seed-pods in various stages of development were displayed, and a quantity of the minute seed from the ripe pod was shown in a Petri dish.

Demonstrations of the actual work of removing the seedling from flask to flask and from flask to the thimble pots were given three times daily. The attendance at these demonstrations and the daily broadcasting over the radio of the talk connected with them attested to the interest and enthusiasm in the Garden exhibit. A special demonstration was given Mrs. Herbert Hoover and distinguished visitors during the private viewing of the show which was held on Thursday afternoon, October 18, following the completion of the judging.

The Garden received the Mrs. F. E. Dixon silver cup as a first prize for the exhibit showing the development of orchids from seed. The large exhibition gold medal of the American Orchid Society was awarded to Elinor Alberts Linder, Orchidologist to the Garden, for horticultural effort in developing the growing of orchids from seed.

G. H. P.
E. A. L.

NOTES

Dr. George T. Moore, Director of the Garden, spoke before the Garden Club of St. Louis, October 21, on "What Goes on in the Plant."

The third annual dahlia and fall flower show of the St. Louis Horticultural Society was held at the Missouri Botanical Garden, October 18 and 19.

Mr. G. H. Pring, Superintendent of the Garden, is the author of an article on "Chrysanthemums" in the November, 1930, number of the "Ladies' Home Journal."

The convention of the American Institute of Park Executives visited the Garden, September 30, and the convention of the American Society of Civil Engineers, October 9.

The October, 1930, number of the "American Druggist" contains an article by Mr. Anton Hogstad, Jr., Pharmacognosist to the Garden, entitled "Coming Back, the Show-Globe, Emblem of Pharmacy."

Mrs. Katherine H. Leigh, Assistant to the Director, and Miss Ruth L. Barry, spoke before the St. Louis Horticultural Society, October 3, on "Glass Gardens for the Home" and gave a demonstration of making one of these gardens.

Mr. G. H. Pring, Superintendent of the Garden, lectured before the Osage Hills Garden Club, September 26, on "Flowering Plants for the Garden," and before the convention of Park Executives, September 30, on "Plant Movements."

Dr. J. M. Greenman, Curator of the Herbarium (on leave of absence); Dr. Adele L. Grant, Acting Curator of the Herbarium; Dr. Edgar Anderson, Geneticist to the Garden; Dr. Robert E. Woodson, Research Assistant to the Garden, and Miss Caroline K. Allen, student in the Henry Shaw School of Botany, attended the Fifth International Botanical Congress, held in Cambridge, England, August 16-23.

Dr. R. V. La Garde, Research Assistant to the Garden, has returned from a trip of two and one-half months in Europe. He visited the principal gardens and arboretums in central Europe and the orchid nurseries in Schönbrunn, Austria. While in Prague he gave a talk before the German Students'

Union on "Universities and University Life in America."

Recent visitors to the Garden include Dr. Donald Reddick, professor of plant pathology, Cornell University; Dr. Harold C. Bryant, head of the educational department, National Park Service, Washington, D. C.; Dr. Victor E. Levine, professor of biochemistry, Creighton University, Omaha, Neb.; Dr. Arthur D. Houghton, of Los Angeles, Cal.; Dr. Frederick R. Wellman, of the U. S. Department of Agriculture; Dr. Walter F. Loehwing, professor of plant physiology, University of Iowa.

Mr. Anton Hogstad, Jr., Pharmacognosist to the Garden, gave a talk before the Naturalists' Club of St. Louis, September 27, at its thirty-second anniversary meeting, on "Some Chemico-Pharmacological Aspects of the Nightshade Family." On October 15 he gave the opening lecture for the 1930-31 season of the Colloid Medical Seminar, at the Coronado Hotel, discussing the subject "Isomerism . . . as a Related Phenomenon to that of Colloidal Chemistry."

Students pursuing graduate work in the Henry Shaw School of Botany, either at the Missouri Botanical Garden or in Rebstock Hall at Washington University, during the academic year 1930-31, are as follows:

Instructor.—Martha L. Beardsley, A. B. and M. S. Washington University.

Assistants.—Alexander F. Bucholtz, student at Dorpat University, Dorpat, Esthonia, B. S. Cornell University, M. S. Washington University; Harry J. Fuller, A. B. and M. S. Washington University; Mary Elizabeth Pinkerton, B. S. University of Nebraska.

Rufus J. Lackland Fellows.—George J. Goodman, A. B. University of Wyoming, M. S. Washington University; Leo C. Hitchcock, A. B. and A. M. Pomona College; John Adam Moore, B. S. Butler College, M. S. Washington State College; Julian Steyermark, A. B. and M. S. Washington University; F. Lyle Wynd, B. S. and M. S. University of Oregon.

Jessie R. Barr Fellowship.—Marion Child, A. B. Oberlin College, M. S. Washington University.

Washington University Scholarship.—Josephine Darling-

ton, A. B., B. S. in Forestry, University of Montana, M. S. Washington University.

Fellowship of American Creosoting Co.—Earl E. Berkley, A. B. University of West Virginia, M. S. Washington University.

Special Garden Fellowships.—Caroline K. Allen, A. B. Vassar College, M. S. Washington University; Lily M. Perry, B. A. Acadia University, Wolfville, Nova Scotia; Paul F. Shope, B. S. Pennsylvania State College, M. S. University of Colorado.

Special Fellowship.—Chienfan Li, A. B. Yenshing University, China.

Other students.—George D. Diehl, A. B. Grinnell College; Dorothy Megowen, A. B. University of Illinois; Mary Ledgerwood, A. B. Harris Teachers College.

STATISTICAL INFORMATION FOR SEPTEMBER, 1930

GARDEN ATTENDANCE:

Total number of visitors	40,537

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	69
Total number of books and pamphlets donated	206

PLANT ACCESSIONS:

Total number of plants and seed packets donated	25
Total number of plants and seed packets purchased	75

HERBARIUM ACCESSIONS:

By Purchase—	
Stanford, Prof. E. E.—Plants from California and Oregon	200
By Exchange—	
O'Neill, Hugh—Plants of the southeastern states	161
By Gift—	
Wilson, P.—Plants from New York	1
Total	362

FLORAL DISPLAYS OF SPECIAL INTEREST IN 1930

In order that readers of the BULLETIN may have a more comprehensive idea of the various flower shows and outdoor exhibits which from month to month may be seen at the Garden, the following tentative schedule is given. While the indoor exhibits can be quite definitely indicated, the blooming period of outdoor plants is subject to variation, depending upon the weather, and out-of-town readers should confirm the date of any display before visiting the Garden.

JANUARY

(Floral Display House)
Orchids, Primroses, and Cyclamen.

FEBRUARY

(Floral Display House)
First half month—Orchids.
Second half month—Cinerarias.

MARCH

(Floral Display House)
March 1-17—Bulb Show.
March 20-23—St. Louis Florists' Show.
March 29—Azalea Show.

APRIL

(Floral Display House)
Azaleas, Roses, Schizanthus.
(Outdoors)
Pansies, English Daisies, Early-flowering Shrubs.

MAY

(Floral Display House)
Hybrid Pelargoniums, Salpiglossis, Begonias, Marguerites, Lupines, and other spring annuals.
(Outdoors)
Bulbs (early in month), Hardy Water-lilies, Peonies.
Iris (late in month), Spring-flowering shrubs and perennials.

JUNE

(Outdoors)
Roses, Hollyhocks. Medicinal Garden.

JULY

(Outdoors)
Tropical plants. Annuals. Economic Garden—farm crops, fiber plants, rice, cotton, peanuts, tobacco, sugar-cane. Medicinal Garden.

AUGUST

(Outdoors)
Tropical Water-lilies, Victoria Cruziana, Lotus lilies. Economic Garden. Medicinal Garden.

SEPTEMBER

(Outdoors)
Tropical Water-lilies. Economic Garden. Medicinal Garden.

OCTOBER

(Floral Display House)
Dahlia (novelties and newer varieties).

NOVEMBER

(Floral Display House)
Chrysanthemum Show.

DECEMBER

(Floral Display House)
Poinsettias, Stevias.

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove avenue and Flora place, on the Sarah car line (No. 42). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motorbus lines transfer.

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MISSOURI BOTANICAL GARDEN BULLETIN

Vol. XVIII NOVEMBER, 1930 No. 9

CONTENTS

Page

The Three Hundredth Anniversary of the First Recognized Use of Cinchona 141
Warnings for Winter 154
Notes 155
Statistical Information. 156
Floral Displays of Special Interest in 1930

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EXHIBIT OF PROPAGANDA MATERIAL OF THE KINABUREAU OF NETHERLANDS

A, heading; B, painting "Anguish"; C-F, posters for Dutch East Indies, G, for Jugoslavia, H, Algeria and Morocco; I-L, calendars; M, disc for Siam; N-W, books and circulars about malaria and quinine.

Missouri Botanical Garden Bulletin

Vol. XVIII NOVEMBER, 1930 No. 9

THE THREE HUNDREDTH ANNIVERSARY OF THE FIRST RECOGNIZED USE OF CINCHONA

HELD AT THE MISSOURI BOTANICAL GARDEN, OCTOBER 31 AND NOVEMBER 1, 1930.

For three hundred years mankind has enjoyed the blessing of the febrifuge properties of cinchona or quinine bark. Nothing is actually known as to the discovery of the febrifuge properties of this bark, but many legends concerning it are to be found in historical archives. One of the most interesting is that some trees in the Peruvian wilds were blown into a pool by the wind, and thereby the water became very bitter, in fact so bitter that the natives refused to drink it. One day a native was seized with a violent fever, and finding no other water to quench his thirst, he was forced to drink of the water from this pool, with the result that he was cured. He then related his wonderful discovery to the other inhabitants of the district, and thus the fame of the febrifuge qualities of cinchona bark became known.

The year 1638 has been generally accepted as the date of the first recognized use of this bark, in which year Countess Ana de Chinchon, wife of the viceroy of Peru, Luis Geronimo Fernandez de Cabrera y Bobadilla, was cured of the intermittent fever. The powdered bark used in this connection had been received from a Spanish corregidor, Don Juan Lopez de Canizares, who having learned of the illness of the Countess,

had sent a packet of the powdered drug to Don Juan de Vega, her physician.

Search among the old books at the Missouri Botanical Garden library revealed the fact that eight years earlier this Spanish corregidor had likewise been cured of the intermittent fever by means of cinchona bark, thus establishing the date of the first recognized use of cinchona as the year 1630. It is interesting to note that this finding has been verified by Dr. E. M. Holmes, Ph. C., president of the British Pharmaceutical Conference, in an article entitled, "Three Hundred Years of Cinchona" which recently appeared in the "Chemist and Druggist" (London).

Upon recovery, the Countess Ana de Chinchon caused the bark to be collected in large quantities and given to others who were suffering from intermittent fever. The powdered bark then became known as Polvo de la Condesa, i. e., the Countess' Powder. In the spring of 1640, the Countess returned to her native home, Chinchon, in Spain, bringing with her a quantity of the remedy for distribution to the sufferers of the tertian ague on her husband's estate. Dr. Juan de Vega, physician to the Countess, followed his patient back to Spain and he also brought with him a quantity of cinchona bark, which he sold at Seville for 100 reals (one real is equivalent to 10 cents) per pound. Some authorities state that cinchona bark had found its way to Spain in 1639, one year before the return of the Countess, for in that year it had been tried at Alcala de Henares, near Madrid.

Owing to the many requests for the Countess' Powder, the Countess of Chinchon transferred the distribution of this bark to the Jesuit fathers, it then being assigned the name of Jesuit's bark.

In 1649, a large quantity of the bark was exported to Europe by the Jesuit fathers, being received by Cardinal Juan de Lugo at Rome, who distributed it to members of that fraternity throughout Europe. It was later carried to Belgium by these same priests. Jesuit's bark was introduced into England by James Tompson, a merchant of Antwerp, and in 1655, when there was a wide-spread epidemic of intermittent fever, it became greatly advertised.

Robert Talbor, an apprentice to Dean, an apothecary of Cambridge, took an active part in the usage of Jesuit's

powder. In 1672 he published a book dealing with the cause and cure of agues. Through his cures his reputation rapidly spread, and in 1678 he was appointed physician to King Charles II. In 1679 he visted France and cured a number of prominent persons of intermittent fever, but he was always very careful not to let it be known that he was employing Jesuit's bark in the treatment. Louis XIV, having been informed of Talbor's remarkable achievements with intermittent fever, induced him to sell his secret for the sum of 2000 livres (a livre at that time being equivalent to about twenty cents). Talbor died in 1681, in which year Louis XIV published his method of curing intermittent fever.

Although the bark was employed in 1630 in effecting a cure for Don Juan Lopez de Canizares, and afterwards was widely diffused and utilized throughout Europe, no attention was devoted to the sources of this remarkable bark for almost one hundred years. The first authentic record of anyone seeking the source of cinchona is that of the endeavor of Charles-Marie de la Condamine, a French astronomer, who, when measuring the arc of a degree near Quito, availed himself of the opportunity of being in the vicinity to investigate the origin of the famous Peruvian bark. In the year 1737 (February), he collected specimens of this bark at Sierra de Cajanuma, about two and one-half leagues from Loxa, where the Spanish corregidor, Don Juan de Canizares, had been cured of the intermittent fever in 1630. In 1738 he published an account of his findings, which was supplemented with a number of illustrations.

In 1742, Linnaeus, the father of the binomial system of plant nomenclature, assigned the name of Cinchona to this genus of plants in honor of the Countess of Chinchon. In so doing he was not aware that he had left out the letter "h" in the spelling of the word "Chinchon," with the result that this genus of plants then became known as "Cinchona" instead of "Chinchona." His mistake was not discovered until many years later. Several attempts have been made to correct the error, one such an attempt being made at an international botanical congress, but without avail. The name "Cinchona" had become too firmly implanted in the minds of the botanists and quinologists, and the Linnaean spelling

was recognized by the Revision Committee of the United States Pharmacopoeia (Tenth Decennial Revision).

Following the work of Condamine, many expeditions set forth to South America. These expeditions were in charge of such men as Markham, Mutis, Ruiz and Pavon, Caldas, Humboldt, Bonpland, Weddell, Tafalla, and others.

Much difficulty was encountered in removing the cinchona from South America, especially the seeds. The inhabitants of the cinchona areas in South America became suspicious of the real intent of the plant collectors and made every effort to prevent them from shipping the seed to Europe. Beyond a doubt, no other group of drug plant explorers suffered more hardships than those who went forth in search of the famous cinchona trees. An excellent account of the many trials encountered by Markham has been given in a book, "The Life of Sir Clements Markham," written by Sir Albert H. Markham (London, 1917).

Although the original trees were found growing in South America, in the Andes mountains at an altitude of 5,000 to 8,000 feet, this continent no longer enjoys the pleasure of supplying the world with this famous bark, the only and original source of the important alkaloid, quinine. Today 97 per cent of the world's production of this bark is being conducted in Java, under the direction of the Dutch. Some 2½ per cent is being produced in British India and about ½ per cent in the remainder of the world. Such is but one of the many tales that can be related about cinchona bark. Perhaps no other drug in our vegetable *materia medica* has as much to offer of an interesting nature as cinchona. Further, no other drug has passed through more trials and vicissitudes. It has been subject to all types of quackery of the worst kind. but it still remains supreme.

Some little concern was felt a few years ago when the announcement was made that a synthetic quinine had been produced by the modern chemist in his organic chemical laboratory, and many predicted that success in this connection would mean a downfall of the Java cinchona industry. Clinical investigation, however, has failed to substantiate the anticipation that this new substance, "Plasmochin," would replace the alkaloid quinine. It has been found to be of value as a

complementary drug when used in conjunction with quinine as a specific in the treatment of malarial fever. It is of interest to record at this point a statement made by Dr. M. Kerbosch, of Java, who was present at the Tercentenary Celebration just recently held at the Missouri Botanical Garden, to the effect that one-third of the population of the world is suffering from malarial fever. This is due to the large number of persons living in the malaria-infected areas of the globe.

In connection with the work dealing with the synthesis of quinine or a quinine-like substance it is interesting to note that the world today enjoys the many benefits of the aniline dye industry through the work of Perkins, a noted chemist, who at one time attempted to synthesize quinine. Instead of obtaining quinine, he was rewarded by the achievement of producing the first aniline dye, a yellow dye known as mauve. This discovery gave birth to the vast so-called "coal tar industry" that today is supplying thousands of medicines, dyes, perfumes, etc.

This in brief is the story of a drug that occupies a prominent place in the vegetable *materia medica* of the pharmacist and the physician. Today the alkaloid quinine stands supreme in the treatment of malarial fever. A noted physician once said that if any one of his colleagues was unable to effect a cure for malaria by the use of quinine, he ought to relinquish the practice of medicine.

Having established the date of the first recognized use of cinchona as being 1630, it seemed fitting and worth while, since the year 1930 marks the anniversary of three hundred years of cinchona medication, to commemorate such a date—to pause in the rush of a busy life and to reflect on the role of a drug that has been official in every edition of the United States Pharmacopoeia since 1820.

The Missouri Botanical Garden, with its many excellent features, including one of the finest and most comprehensive of libraries, a lecture hall unique in character, display rooms, conservatories, etc., presented much as an ideal setting for a gathering of scientists. Accordingly, invitations were extended to scientists, including the leading quinologists, over the world, to participate in such an international gathering. The preliminary plans called for a symposium covering all phases of a botanical, chemical, pharmaceutical, and

pharmacological nature, relative to the drug cinchona. It was likewise deemed advisable to bring together what perhaps would prove to be the most comprehensive collection of cinchona barks, their alkaloids, salts and derivatives, as well as photographs, books, etc., that had ever been shown at any one time in the history of a single drug of our vast vegetable *materia medica*.

The response was more than gratifying. From Java journeyed Dr. M. Kerbosch, Director, Government Cinchona Estate and Cinchona Experimental Station at Tjinjiroean, Pengalengan, Java, having been accorded a four months' leave of absence by the Java Government. Today Doctor Kerbosch is recognized as the world's leading authority on the cultivation of cinchona trees, for from the trees under his personal supervision comes 97 per cent of the world's supply of the bark.

From Maarssen, Netherlands, came Dr. A. R. Van Linge, president of the Nederlandsche Kininefabriek, who occupies the responsible position of head of the so-called Dutch Quinine Monopoly. During the summer of 1929 the Missouri Botanical Garden was visited by the son of Dr. Van Linge, who, during a world tour with his wife, stopped off in St. Louis to inspect the Garden. When informed of the proposed Cinchona Tercentenary Celebration the younger Van Linge remarked that he felt sure that his father would gladly cooperate in such a remarkable undertaking. The result was that this gathering was honored by the presence of this noted quinologist.

Germany was represented by Dr. Karl Merck, president of Merck & Company, of Darmstadt, manufacturers of fine chemicals since 1668. The City of Glasgow, Scotland, sent their personal representative, Mr. W. D. Besant, Director of Parks and Botanic Gardens of that city.

A number of noted American quinologists were in attendance. Among them was Dr. George D. Rosengarten, of Philadelphia, member of the well-known firm of Powers-Weightman-Rosengarten (now merged with Merck & Co., Inc., Rahway, N. J.), which was the first to produce quinine on a commercial scale in this country. Quinine was produced in Philadelphia by this firm in 1823, three years after it had been isolated from cinchona bark by two French scientists. Pelle-

tier and Caventou. Mr. G. W. Merck, president of Merck & Co., Inc., was likewise present, Other guests included Dr. Torald Sollman, professor of Pharmacology, Western Reserve University; Dr. Kenneth F. Maxcy, University of Virginia, an authority on malarial fever; Dr. Wilbur L. Scoville, dean of American pharmacists, from Detroit; Dr. Edward Kremers, the volatile oil authority and phytochemist, from the University of Wisconsin; and Dr. George Dock, of Pasadena, California, formerly of St. Louis.

The proceedings of the congress are to appear shortly in full in a volume devoted to the celebration. Following is a program of the events:

PROGRAM
CELEBRATION OF
THE THREE HUNDREDTH ANNIVERSARY
OF THE
FIRST RECOGNIZED USE OF
CINCHONA

Friday, October 31—Saturday, November 1, 1930

Saint Louis

FRIDAY, OCTOBER 31

10:00 a. m.

Assemble at the main entrance to the Garden (Tower Grove avenue and Flora place). Viewing of the Chrysanthemum Show and trip through conservatories.

10:30 a. m.

Exhibition of books, pictures, crude materials, and drugs pertaining to cinchona.

11:00 a. m.

Assemble in the "Library and Museum" Building.

Address of Welcome.....Director George T. Moore

"THE HISTORY OF CINCHONA"

The Drug.....Professor Leo Suppan
St. Louis College of Pharmacy

The Chemical.....Dr. Edward Kremers
University of Wisconsin

The Medicinal Use.....Dr. George Dock
Pasadena, California

Dr. John Sappington, Pioneer in the Use of Quinine in the Mississippi Valley .....Professor Robert J. Terry
Washington University
School of Medicine

1:00 p m.
Luncheon at the Garden

2:00 p. m.

"THE CINCHONA INDUSTRY OF JAVA"
Dr. M. Kerbosch
Director, Government Cinchona Estate and Cinchona Experimental Station
"Tjinjiroean," Pengalengan, Java

"THE PHARMACEUTICAL PREPARATIONS OF CINCHONA"
Dr. Wilbur L. Scoville,
Detroit, Michigan

"MINOR ALKALOIDS OF CINCHONA BARK"
Mr. Frederic Rosengarten
Philadelphia, Pennsylvania

"THE CINCHONA ALKALOIDS IN MEDICAL SCIENCE"
Dr. Torald Sollman
Western Reserve University, Cleveland, Ohio

"THE PRESENT CONCEPTION OF THE ACTION OF QUININE IN MALARIA"
Dr. Kenneth F. Maxcy
University of Virginia

7:30 p. m.

Trustees' Banquet, Hotel Jefferson

Mr. George C. Hitchcock
President Board of Trustees, Missouri Botanical Garden, Presiding

Speakers:

Dr. C. E. Caspari
Dean, St. Louis College of Pharmacy
St. Louis, Missouri
Representing Pharmacy

Mr. W. D. Besant
Director of Parks and Botanic Gardens,
Glasgow, Scotland
Representing Botany

Dr. George D. Rosengarten
Past President of American Chemical Society
Malvern, Pennsylvania
Representing Chemistry

Dr. A. R. Van Linge
N. V. Nederlandsche Kininefabriek
Maarssen, Netherlands
Representing Industry

SATURDAY, NOVEMBER 1

10:30 a. m.

Assemble at the Garden to view Library, Herbarium, and special exhibits.

11:30 a. m.

Leave Museum Building (Cleveland avenue gate) for Missouri Botanical Garden Extension, Gray Summit, Missouri.

1:00 p. m.

Luncheon.

2:00 p. m.

View orchid seedlings and collections. For any who desire it, trips will be arranged to various parts of the grounds.

3:30 p. m.

Return to city.

8:00—10:00 p. m.

Reception at Director's residence.

In the address of welcome by Dr. George T. Moore, Director of the Missouri Botanical Garden, attention was called to the importance of the work of the vegetable kingdom from a humanitarian point of view, as well as the need of commemorating such a date as 1630, the date of the first recognized use of cinchona.

Professor Suppan's paper dealing with the history of this interesting and important drug represented beyond a doubt one of the most comprehensive papers on this subject ever prepared. Professor Suppan spent many months in intensive investigation at the Missouri Botanical Garden, reviewing all of the literature in the various languages.

Mr. Frederic Rosengarten of Philadelphia, being in Europe at the time, his paper on the "Minor Alkaloids of Cinchona," was read by his brother, Dr. G. D. Rosengarten. This paper dealt at some length with the alkaloids cinchonine, cinchonidine, and quinidine, the latter having gained considerable popularity during the past few years as an alternate drug with that of Digitalis in the treatment of auricular fibrillation. In addition to these three alkaloids, the substance designated as chinoidin was likewise discussed, in which it was pointed out that this substance apparently has many uses as yet unknown.

In discussing the chemical aspects of cinchona, Doctor Edward Kremers reviewed the many pitfalls and complications

in the path of the phytochemist, as well as pointing out the need for more intensive phytochemical research in the future.

Doctor George Dock, formerly of St. Louis, reviewed the medical aspects of the bark, for the most part dealing with the many interesting points relative to its history.

The paper by Doctor Robert J. Terry, on the life and activities of Dr. John Sappington (1776-1856), of Arrow Rock, Missouri, was of especial interest, owing to the fact that through the endeavors of Doctor Sappington, quinine was introduced in the Mississippi Valley in the treatment of malarial fever.

Dr. M. Kerbosch, of Java, presented a very comprehensive picture of the entire cinchona culture industry, and also explained the true purpose of the so-called "Dutch Quinine Monopoly," which is to the effect that this organization is expending every effort to distribute quinine as cheaply as possible for the millions of persons suffering from malarial fever. As stated previously, it is to be remembered that one-third of the population of the world is affected with malarial fever. The paper was supplemented by motion pictures of cinchona culture, prepared especially for this celebration. They were remarkable in every respect, and brought to those interested in this subject the first depiction of every stage in the culture, collection, and preparation of this important drug.

From the dean of American pharmacists, Dr. Wilbur L. Scoville, much was learned about the galenical preparations of this drug, as well as the many problems that the manufacturer of cinchona pharmaceutical preparations has to face every day. Simple percolation is no longer the only problem. It is essential to prepare these pharmaceutical preparations in such a manner that they will retain their efficiency, as well as to eliminate the objectionable features of sedimentation. Doctor Scoville exploded the old-time theory of slow percolation, stating that in the case of cinchona extraction, a rapid percolation was far superior.

Dr. Torald Sollman, the noted American pharmacologist, dealt with the cinchona alkaloids in medical science. The paper was replete at every point with clear-cut facts as to the role of the cinchona alkaloids in modern medical practice. It was interesting to learn from this noted pharmacologist that the branch of pharmacology known as chemotherapy did not

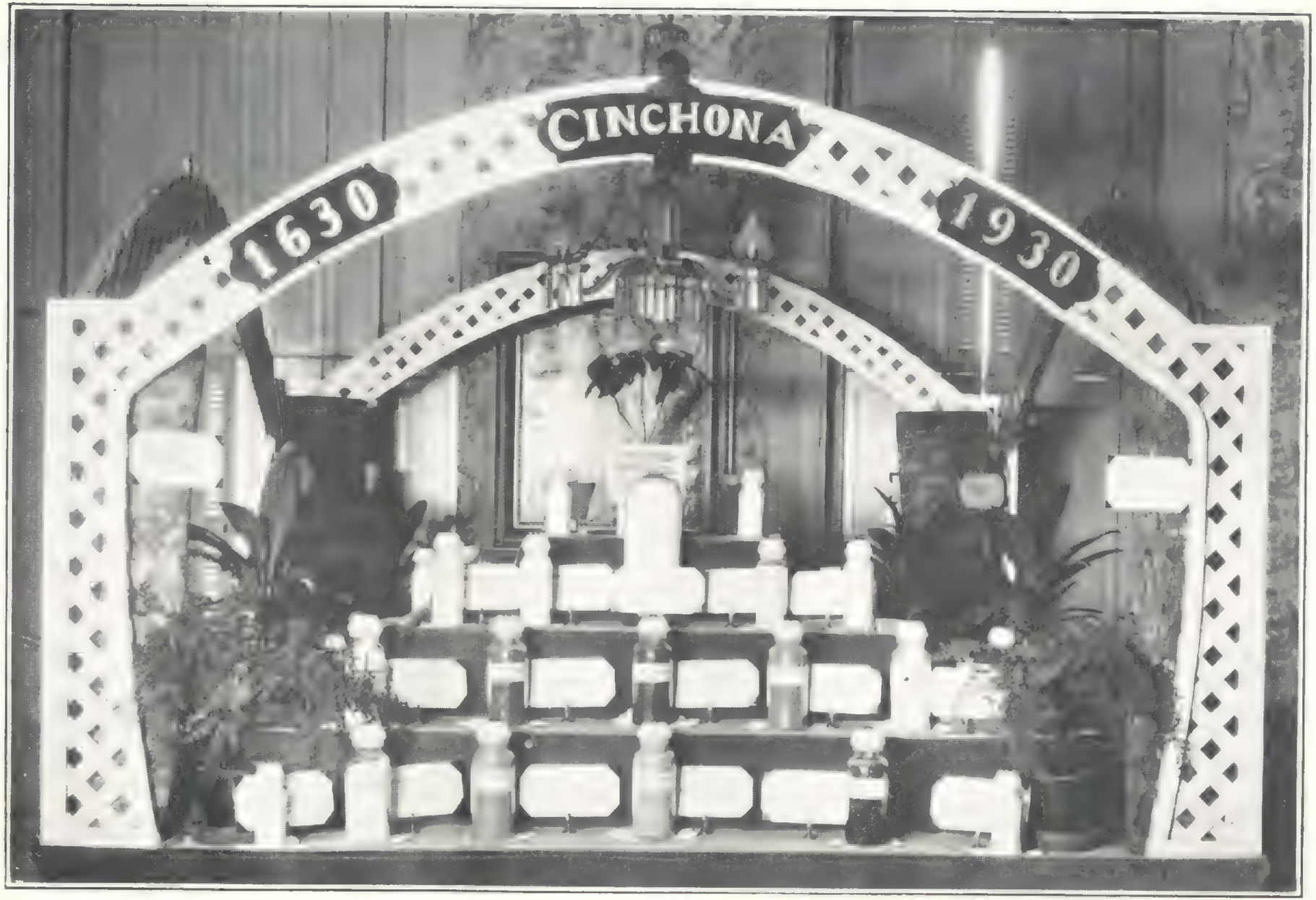


EXHIBIT OF MERCK & CO., INC., SUCCESSORS TO POWERS-WEIGHTMAN-ROSENGARTEN CO., 1905-1927, POWERS & WEIGHTMAN, 1818-1905, FIRST TO MANUFACTURE QUININE IN THE UNITED STATES, 1823.

PLATE 34.

SOME OF THE RELICS OF DR. JOHN SAPPINGTON

Included are agreement of sale for 10,000 boxes of Sappington's Antifever Pills, his medicine chest, surgical instruments, photographs of The Old Tavern at Arrow Rock, Missouri.

have its origin in the monumental and classic work of Ehrlich on the salvarsans but rather on the discovery of cinchona in 1630, for today quinine represents one of the few specific medicines.

The paper dealing with the present conception of the action of quinine in malaria, by Dr. Kenneth F. Maxcy, of the University of Virginia, was a comprehensive review of this vast and complicated problem. Apparently there is much yet to be learned of the mode of action of quinine in the treatment of malarial fever, for this problem, like others of the serological nature, involves the complicated study of blood chemistry, together with an appreciation of its colloid-chemical aspects.

The scientific program occupied the morning and afternoon of Friday, October 31, and a portion of the morning of November 1.

The Trustees' Banquet, on the evening of Friday, October 31, proved to be a most delightful occasion, at which time three hundred guests were entertained. Mr. George C. Hitchcock, President of the Board of Trustees of the Missouri Botanical Garden, was toastmaster for the occasion. It will be noted from the program that Dr. C. E. Caspari, dean of the St. Louis College of Pharmacy, spoke in behalf of Pharmacy; Mr. W. D. Besant, of Glasgow, Scotland, for Botany; Dr. G. D. Rosengarten, of Philadelphia, for Chemistry, and Dr. A. R. Van Linge, of Maarssen, Netherlands, for Industry.

The trip to Gray Summit, Missouri, where the Missouri Botanical Garden maintains an extension of 1600 acres, and where is housed the world's greatest collection of orchids, was a most enjoyable occasion. Two motor busses were chartered for the trip. The fall colorations of the oaks, sumacs, and other shrubs and trees were at their most gorgeous, and afforded the guests an excellent opportunity to note the autumnal beauty of the State of Missouri. After a delightful repast served at the Administration Building, the delegates inspected the collection of orchids. Elinor Alberts Linder, Orchidologist to the Missouri Botanical Garden, then explained the various steps in the growing of orchids from seed. Her talk was supplemented with the display of orchid seedlings that had just recently been exhibited at the meeting of the American Orchid Society, Washington, D. C.

The Tercentenary Celebration of the first recognized use of

cinchona was brought to a close by a reception held at the residence of the Director, on Saturday evening, November 1, at which time friendly greetings were exchanged and many new friendships formed.

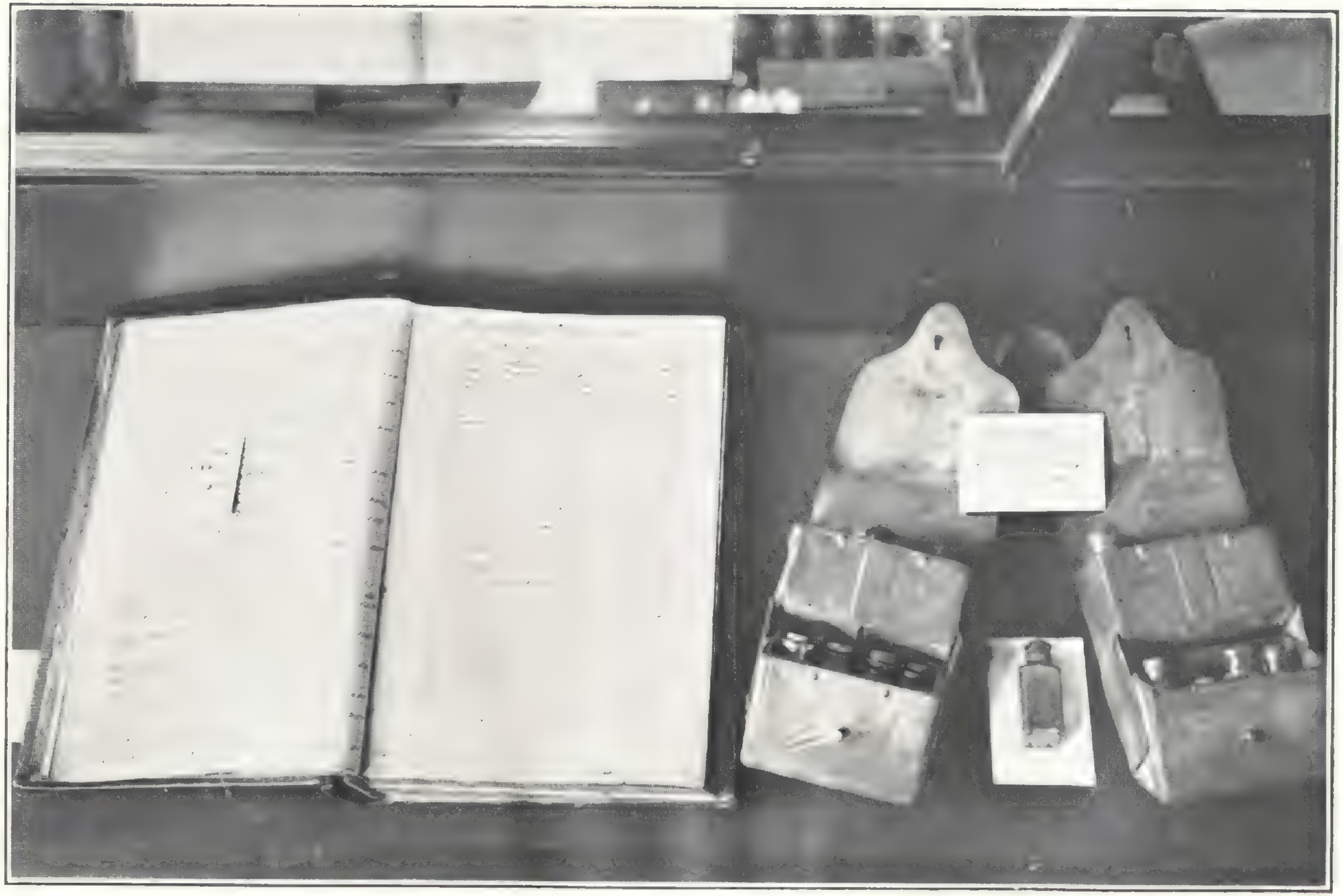
The lower floor of the Henry Shaw residence, now devoted to a collection of historical objects, was utilized for the various cinchona exhibits—exhibits that represented the most comprehensive collection of cinchona bark and its products ever assembled in the past three hundred years of cinchona medication. Through the courtesy of Merck and Company, Inc., logs of cinchona trees of varying ages with barks attached, quills of the bark, a bale of ground cinchona bark, roots, branches, etc., had been imported from Java for this occasion. In addition to the above items, this firm exhibited a complete list of cinchona alkaloids, their salts and derivatives, both in crude and purified forms (pl. 33). The Mallinckrodt Chemical Works, St. Louis, as well as the New York Quinine and Chemical Works, New York City, likewise exhibited fine collections of cinchona alkaloids and their salts.

From the Kinabureau of Netherlands was imported a unique set of posters telling the story of quinine in relation to the treatment of malarial fever (pl. 32). In addition to these posters a large oil painting, entitled "Anguish," depicted a person dying of malarial fever at the base of a pile of human skulls, and a skeleton with the wings of the mosquito hovering above.

The Société des Quinquinas of Paris, France, sent for the occasion two placques of Pelletier and Caventou, discoverers of quinine.

One of the most interesting of all exhibits was the historical relics of the late Dr. John Sappington, of Arrow Rock, Missouri, loaned by the Daughters of the American Revolution (pls. 34-35). This collection included Doctor Sappington's saddle bags, carpet bag, medicine chest, agreement of sale for 10,000 boxes of Sappington's Antifever Pills at 60 cents per box, and his prescription book, in which was noted that he charged for both mileage and professional call in those early days. An entry for January 31, 1838, shows that he charged $4.00 for 80-extract of cinchona pills.

Dr. M. Kerbosch brought with him from Java a most interesting collection of cinchona barks, fruits, and seeds, speci-



DR. SAPPINGTON'S PRESCRIPTION BOOK, AND THE SADDLE BAGS

FROM WHICH, TRAVELING ON HORSEBACK, HE DISTRIBUTED THE FIRST QUININE USED IN THE MISSISSIPPI VALLEY

mens of cinchona branches, as well as an excellent collection of herbarium specimens of many species of cinchona. He likewise exhibited the method of germination of cinchona seeds, and various forms of animal life that are destructive to cinchona trees.

The Missouri Botanical Garden displayed herbarium specimens and an interesting set of books from the library dealing with all phases of this remarkable drug. The St. Louis College of Pharmacy loaned some books for this exhibit, as did Dr. George Dock, of Pasadena, California.

An added attraction which the Garden offered the guests was the Chrysanthemum Show, which was especially rushed along in order to be in readiness at the time of the celebration.

All in all, this celebration was a most unusual gathering in many respects. It brought together for the first time in the history of this important febrifuge drug the leading quinologists throughout the civilized world. As stated previously, it also afforded an opportunity of displaying the most comprehensive collection of cinchona and its products from the seed to the living plant, as well as all the barks and the many products derived from them. Much was learned of the many hardships endured by those who undertook to search for the source of this remarkable tree in the Peruvian wilds. In a kaleidoscopic manner we were carried over a period of three centuries, during which time was revealed a story replete with points of interest at every turn in the road. We were likewise informed of the many problems confronting the phytochemist and pharmacologist in their quests for remedial agents to alleviate the sufferings of mankind. Also, we were told of the true intent and purpose of the so-called Dutch Quinine Monopoly—information that has changed our opinions of it in many respects. We likewise learned much relative to the perseverance of the Dutch, to whom all credit is due for keeping alive an industry that some years ago seemed doomed, owing to the fact that the market price of quinine was far below the cost of production. When other countries turned to more profiable pursuits, the Dutch kept on, with the result that today quinine—the remedial agent, par excellence for malaria—is to be had throughout portions of the world.

Is it any wonder then that at the close of the Trustees' Banquet in the Gold Room of Hotel Jefferson the guests arose

in silence as the orchestra rendered "Wien Neerlandschbloed" —the National Anthem of Netherlands? It was a just tribute to these noble people tendered in the presence of its two official representatives, Doctors M. Kerbosch and A. R. Van Linge, who had traveled thousands of miles to be present at this auspicious gathering.

—A. H., Jr.

WARNINGS FOR WINTER

Winter affords the gardener an excellent opportunity for pruning trees and shrubs. Broken stubs, frequently caused by storms, stand as much chance to heal over as a broken arm without a splint. Maples or walnut trees should be pruned before December or after April, otherwise excessive bleeding will result. The long icicles often seen hanging from the freshly pruned branches during March illustrate this loss of sap. When pruning shrubs and climbing roses, keep the shears away from the spring-flowering species which flower before the first of June. These should be pruned after flowering if you expect good flowering wood for the next spring to develop.

Examine your trees and shrubs for scale, particularly Cornus for San Jose and oyster-shell, and hawthorns for black-banded scale. Spray the Japanese quince on general principles, as it is a favorite home for scale. Your seedsmen can supply you with dormant sprays.

The past summer has been an unusually dry one, and ornamental trees and shrubs should not be permitted to go into the winter dry. Evergreens should be well soaked. Do not just sprinkle the top soil, but by means of a crowbar or auger drive holes six inches or more deep around the tree and fill with water. When filling the holes, work in some bone meal. A coarse mulch of about four inches around the small evergreens and deciduous shrubs will help to maintain moisture, and cultivation will prevent a hard crust.

Roses, despite the hot, dry weather, have made remarkable growth this year. It suggests that under normal conditions more drainage may help us grow better roses. Do not expect

to succeed with all hybrid tea roses; they are temperamental. Experiment with new varieties before permanently planting in the rose garden. Roses should not be covered too early, as most of the damage in this climate is wrought in late spring. Wait until continued freezing is here, then protect the tender hybrid tea roses and such climbers as Dr. Van Fleet, Silver Moon, etc. Hybrid perpetuals are much hardier. Straw makes an excellent winter cover, and should be placed lightly around the plants so as to permit aeration. As soon as defoliated, bush roses with long canes should be trimmed back to 18 inches, and the weak shoots cut out. Control, or help control leaf spot by raking up and burning fallen leaves.

Prune the old tops or flowering stems of delphiniums, phlox, and peonies. Be sure to examine the roots or bulbs of cannas, dahlias, caladiums, etc. The cellar might be a little too warm, causing rot or rapid drying. Watch the young fruit trees. We have rabbits that bark. A good temporary protection is to wrap the trunks with several layers of magazine sheets. Field mice will also feed upon the roots of young trees, causing considerable damage.

G. H. P.

NOTES

Mr. G. H. Pring, Superintendent of the Garden, has recently been elected president of the St. Louis Horticultural Society.

Dr. Adele L. Grant, Acting Curator of the Herbarium, spoke before the P. E. O., November 5, on "Collecting Plants in South Africa."

Mr. G. H. Pring acted as judge at the national exhibition of orchids given by the American Orchid Society, at Washington, D. C., October 16-18.

Mr. G. H. Pring gave a talk before the St. Louis Horticultural Society, November 7, on "Orchids," and November 25 spoke before the Festus J. Wade Parent-Teachers Association on "A Hunt for Orchids."

Recent visitors to the Garden include Dr. Edward J. Petry, head of the department of biology, Central College, Fayette, Mo.; Mr. W. W. Ashe, of the U. S. Forest Service; and Prof.

N. N. Kuleshov, of the Institute of Applied Botany, United States Soviet Republics.

Dr. George T. Moore, Director of the Garden, gave a lecture illustrated with moving pictures before the Technical Club of Madison, Wis., November 10, on "The Plant Commonwealth"; and was the speaker at one of the McBride lectures, which are maintained at Western Reserve University for the people of Cleveland, November 17, on "Morality in Plants," the lecture being illustrated with moving pictures. He also addressed the Biological Club of Western Reserve University on "Botany and Business."

STATISTICAL INFORMATION FOR OCTOBER, 1930

GARDEN ATTENDANCE:

Total number of visitors	38,638

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	48
Total number of books and pamphlets donated	228

PLANT ACCESSIONS:

Total number of plants donated	10

PLANT DISTRIBUTION:

Total number of plants distributed in exchange	167

HERBARIUM ACCESSIONS:

By Purchase

Valeur, E. J.—Plants of Dominican Republic	287
Sydow, H.—Fungi exotici exsiccati, Nos. 751-900, inclusive	150
Eyerdam, W. J.—Plants of Kamchatka	128

By Gift—

Linder, Mrs. Mary F.—*Macrophonia Candollei*	1
Chase, Mrs. Agnes—Plants of Brazil	17
Leineman, Catharine—Miscellaneous plants	8
British Museum—*Lycium macrophyllum*	1
Diehl, D. G. and others—Fungi of Missouri	7

By Exchange—

Dudley Herbarium—Plants of Pacific Coast	100
U. S. National Herbarium Umbelliferae	225
Total	924

FLORAL DISPLAYS OF SPECIAL INTEREST IN 1930

In order that readers of the BULLETIN may have a more comprehensive idea of the various flower shows and outdoor exhibits which from month to month may be seen at the Garden, the following tentative schedule is given. While the indoor exhibits can be quite definitely indicated, the blooming period of outdoor plants is subject to variation, depending upon the weather, and out-of-town readers should confirm the date of any display before visiting the Garden.

JANUARY

(Floral Display House)
Orchids, Primroses, and Cyclamen.

FEBRUARY

(Floral Display House)
First half month—Orchids.
Second half month—Cinerarias.

MARCH

(Floral Display House)
March 1-17—Bulb Show.
March 20-23—St. Louis Florists' Show.
March 29—Azalea Show.

APRIL

(Floral Display House)
Azaleas, Roses, Schizanthus.
(Outdoors)
Pansies, English Daisies, Early-flowering Shrubs.

MAY

(Floral Display House)
Hybrid Pelargoniums, Salpiglossis, Begonias, Marguerites, Lupines, and other spring annuals.
(Outdoors)
Bulbs (early in month), Hardy Water-lilies, Peonies.
Iris (late in month), Spring-flowering shrubs and perennials.

JUNE

(Outdoors)
Roses, Hollyhocks. Medicinal Garden.

JULY

(Outdoors)
Tropical plants. Annuals. Economic Garden — farm crops, fiber plants, rice, cotton, peanuts, tobacco, sugar-cane. Medicinal Garden.

AUGUST

(Outdoors)
Tropical Water-lilies, Victoria Cruziana, Lotus lilies. Economic Garden. Medicinal Garden.

SEPTEMBER

(Outdoors)
Tropical Water-lilies. Economic Garden. Medicinal Garden.

OCTOBER

(Floral Display House)
Dahlia (novelties and newer varieties).

NOVEMBER

(Floral Display House)
Chrysanthemum Show.

DECEMBER

(Floral Display House)
Poinsettias, Stevias.

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove avenue and Flora place, on the Sarah car line (No. 42). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motorbus lines transfer.

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Missouri Botanical Garden Bulletin

Vol. XVIII DECEMBER, 1930 No. 10

CONTENTS

	Page
A Large Shrub for the Garden	157
Novel Methods of Displaying Chrysanthemums	158
Transplanting Trees and Shrubs	162
Notes	166
Statistical Information	167
Index to Illustrations of Vol. XVIII	169
General Index to Vol. XVIII	171

Floral Displays of Special Interest in 1930

ST. LOUIS, MO.
1930

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BRANCH OF DECIDUOUS HOLLY, SHOWING BERRIES.

FRUITING SPECIMEN OF DECIDUOUS HOLLY, AT EDGE OF LAKE IN NORTH AMERICAN TRACT.

Missouri Botanical Garden Bulletin

Vol. XVIII DECEMBER, 1930 No. 10

A LARGE SHRUB FOR THE GARDEN

Few large shrubs bear flowers of a size and color to make them conspicuous in spring, and in addition in the fall bear fruit whose color is strikingly vivid against a background of autumn foliage. The deciduous holly (*Ilex decidua* Walt.) (pl. 36) does both and is unusually well able to adapt itself to a variety of conditions. In the wet low meadows and river bottoms of the state it attains a height of thirty feet, but in drier situations it will not exceed twelve feet. In spring before the leaves appear the small yellow flowers bloom, giving the whole plant a pale yellow appearance. Later the dark green leaves unfold and remain until the berries attain their scarlet color. From then until the following spring the tip of each branch is clothed with red berries (pl. 37). The berries remain only as long as the branch is attached to the plant.

Since the staminate (male) flowers are borne on one plant and the pistillate (female) on another, some plants are without fruit. To be certain of a crop of berries, which are more showy than the flowers, it is necessary to choose a plant bearing pistillate flowers, or if dug in the fall, one bearing fruit.

In the summer the plant bears a general resemblance to privet. The leaves are approximately the same size, color, and shape, while the general growing habit is almost identical with Ibolian privet. The leaves are oblong and wedge-shaped, with impressed veins on the upper surface, dark green above, paler below. The twigs are light gray. The shrub is found

from Virginia to Florida, west to Illinois, Kansas and Texas. It is admirably adapted to any wet position which for some reason cannot be drained. Its greater height fits it for planting as a background, as a specimen, or in any situation where a taller shrub is required. It is unaffected by city smoke. After planting no pruning except the removal of dead branches is necessary. A. P. B.

NOVEL METHODS OF DISPLAYING CHRYSANTHEMUMS

Mr. W. D. Besant, Director of Parks and Gardens, Glasgow, Scotland, when visiting the Garden during the recent Cinchona celebration, made the following comment on the chrysanthemum show: "This is the most beautiful chrysanthemum exhibition I have ever seen. You Americans are evidently not satisfied with one show in a house, but even have to suspend another from a roof. I will certainly introduce this artistic manner of culture into our own show next season. Please give me full details of its culture."

Hanging Baskets.—The exhibit of chrysanthemums in hanging baskets was first introduced at the Garden in 1920 (see BULLETIN, Vol. 8, pl. 17), at which time six baskets were suspended from the middle of the roof. At the present time thirty-two large baskets and twenty-four small ones exhibited as standards constitute the "aerial" display. For the culture and final development of this feature, a special growing house must be set aside for seven months. It is interesting to note that the varieties first selected and developed during the growing season in 1919 have not been superseded by other or later introductions, with the exception of the large single yellow "Adele Wallner." The original varieties, which still seem to be the best for the purpose, are "Anna" single white, "Cosmos" single pink, and "Yellow Daisy" somewhat suggesting *C. indicum*, the original chrysanthemum from China.

Cultivation in baskets is comparatively simple and within the reach of the amateur who has a greenhouse at his disposal. Cuttings are selected from the varieties named, all of which may be purchased from commercial growers. The short sturdy root cuttings will develop the best plants. These should be rooted in sand (the local Meramec sand preferred)

FLOWERING BRANCH OF DECIDUOUS HOLLY.

FRUITING BRANCHES OF DECIDUOUS HOLLY.

BASKET CHRYSANTHEMUM. "ANNA."

about January 15. Within four weeks the shoots should have sufficient roots to warrant potting into 2½- or 3-inch pots, using a light sandy soil for the first growing medium. As roots develop the plants should be transferred into 4-inch pots. Systematic pinching of the terminal shoots is necessary in order to produce a plant with many lateral branches. The number of pinches necessary varies with the plant, the aim being to produce a so-called bushy specimen. About May 15 the plants should be in readiness for transplanting in baskets. The size of the basket depends entirely upon the desired size of the exhibition plant. Two sizes were selected for the Garden exhibit. For the large specimens which are suspended from the roof a two-foot basket is used, and for the small standards supported upon bamboo poles a one-foot basket is more convenient. Baskets should be made of galvanized wire and not common wire which often will rust out before the end of the season. They should be lined with either sphagnum or sheet moss so as to keep the soil from leaching out during watering, being sure that the layered moss joints overlap. The soil should be a mixture of three parts sod or good garden soil and one part decayed leaves and sand. Pack the soil within the mossed area so that the moss is made firm against the sides of the basket. For the large baskets four specimens are planted in quadrangle outline, and the soil firmed around the ball of roots. The soil should be concave at the surface and come within not more than two inches from the top of the moss. This is to facilitate a thorough watering without the soil being washed over the mossed edge. Pinching should be practised until about the end of July. Subsequent culture is identical with that of the pot chrysanthemum.

Recently a method of obtaining a more pendent growth has been developed by twisting the main stem during July. With one hand the plant is secured at its base, with the other the stem is held against the rim of the basket and at the same time a gentle downward twist is given, just sufficient to break the outer bark and slightly split the woody tissue. The wounded tissue calluses over, leaving the shoot pendent. Needless to say this is a delicate operation and in the hands of a careless person will result in breaking the stem beyond healing.

Cascade Chrysanthemums.—Many kinds of bush chrysan-

themums, particularly the single-flowered types, may be trained to various shapes. An interesting account appeared in the January 11, 1930, 'Gardeners' Chronicle'' (English) of a new style of treatment, differing from the familiar ball and large specimen types. This article, written by K. Yashiroda, Kagawaken, Japan, mentioned as suitable for this work only Japanese varieties of chrysanthemums. Consequently it required a year of experimenting at the Garden to determine which of the varieties commonly grown in this country were best adapted to the cascade effect. Large-flowered single varieties such as "Molly Hunt" and "Melba," which have a heavy stem, were found to be unsuitable, but the more floriferous, wire-stemmed varieties could be grown to almost any desired shape. The original chrysanthemum (*C. indicum*) (pl. 39) lent itself admirably to training for cascades. Of the larger-flowered singles the old variety "Ladysmith" was the best (pls. 40 and 41). Other good varieties for cascade treatment were "Anna," "Benten," bronze and pink "Buckingham," "Columbia," "Cosmos," "Old Gold," "Roupel Beauty," and "Yellow Daisy."

In order to produce cascade effects constant attention must be given during the entire growing season. Cuttings should be rooted early, and as soon as the young plants are five or six inches high they should be pinched back, leaving four or five leaves. When lateral shoots have formed in the axils of the leaves, the uppermost one is left unpinched to form the leader or growing tip of the plant, and each of the remaining side-shoots is pinched back to two or three leaves. As growth continues these lateral branches when pinched will give rise to sub-laterals, which in turn are pinched to two or three leaves. This repeated pinching, which must be done at least once a week, will gradually produce a plant bushy at the base. As soon as the leader has grown about a foot high, the plant now being in a four- or five-inch pot, a long bamboo cane is pushed into the soil at an angle of 45 degrees. The plants are then set on a bench, with the bamboo cane pointing north. The leader must be tied close to the bamboo support, and every few days as the stem grows it should be tied. If this is neglected the leader will grow up vertically from the last tie. As it grows in length more laterals will

HANGING BASKET
CHRYSANTHEMUM INDICUM

CASCADE CHRYSANTHEMUM
"LADYSMITH". FRONT VIEW.

form along the sides and these should be pinched in the same manner as the first basal shoots. As with other chrysanthemums grown in pots, repotting must be attended to several times during the season. The plants are awkward to handle after they have attained considerable size, and two persons will be required for this operation, one to hold the plant and the other to do the potting. If the plant becomes too broad at the base additional wire or bamboo supports will be needed to prevent it from twisting. Bringing the leading shoot gradually into the horizontal plane causes the lateral shoots to adjust their position for the final lowering of the entire stem and turning of the plant to the south. By September 1 the leading shoot should be horizontal, and by October 1 it should be in its final position.

The operation of removing the bamboo support and lowering the plant over the side of the pot in a vertical position must be done slowly and carefully. If the stem near the base of the pot where most of the bending takes place is hard and in danger of splitting it should be wrapped with raffia before lowering into the final position. If the plant is not more than five feet long the stem probably will hang in place without any additional support after being hung over the side of the pot.

The essential points to remember in training chrysanthemums into pendent or cascade shapes are:

Start the plants early (December or January).

Retain one leader and keep it tied to the support placed at an angle of forty-five degrees.

Have the leader always pointing to the north, thereby exposing the entire plant to the same amount of sunlight.

Pinch the laterals repeatedly.

Lower the leader gradually so that it will be horizontal by September 1, but still pointing north.

Repot when necessary.

Discontinue pinching September 15.

Suspend leader in vertical position October 1 and turn plant to the south.

The other operations of watering, spraying, insect prevention, and fertilization are performed as for any pot-grown chrysanthemum.

G. H. P.
P. A. K.

TRANSPLANTING TREES AND SHRUBS

Replanting small trees and shrubs, which have been brought from the nursery, is attended with but little danger of loss. The transplanting of larger trees and mature shrubs is, of course, accompanied by a proportionately greater amount of risk. Previous neglect and age greatly increase the risk, while more care and attention after planting will do much to lessen it. Transplanting is, and must be considered, a serious operation, one which may result in the death of the plant.

The experienced gardener can successfully move shrubs and small trees at any time of the year, but he takes into consideration the new and changed conditions under which the plant must live after transplanting. He prepares for this by mulching, watering, pruning, and sometimes shading. Shrubs and trees may be moved safely any time after the beginning of dormancy, except during the coldest days of winter, and as late in the spring as the buds remain unopened. Late spring planting requires the lifting of a large ball of earth, to save as many of the fibrous roots as possible. These roots and their accompanying minute hairs are the absorbing organs of the plant, the larger roots serving only as anchors. Early fall planting is therefore more likely to succeed, since it gives time for the cut surfaces of the roots to heal and the absorbing hair to form long before active growth begins.

In digging shrubs from a nursery row the ball surrounding the roots must be in proportion to the size of the plant (pl. 43, fig. A). In fig. B the shrub is being root-pruned. Note that though much of the soil has fallen from the roots, most of the fibrous roots have been preserved and that only a few of the larger roots have been cut in digging. These larger roots must now be pruned so as to remove all torn ends and leave a smooth cut surface in contact with the soil.

The pruning of a small tree before planting has a direct bearing on its future health. If properly pruned at this time, most future structural weaknesses, such as sharp "V"

CASCADE CHRYSANTHEMUM
"LADYSMITH", SIDE VIEW.

GROUP OF CASCADE CHRYSANTHEMUMS.

crotches, can be eliminated. Plate 44, fig. A, shows a sycamore just after being dug. The large roots have broken in digging, and lateral branches are growing near the ground. These roots must be cut back to an unbroken area (fig. B), and the low lateral branches removed to compensate for the loss of the roots but the leader must not be shortened. Should some of the top die before growth starts in spring, usually only a single lateral bud will continue upward growth. If the leader, or upward-growing central stem, is much shortened, many buds will compete for leadership, causing a number of weak crotches to form. These must later be removed, and often it is necessary at a time when the tree ought not be heavily pruned.

The next and most important step is the actual setting of the tree or shrub. It should be planted at least one or one and one-half inches lower than it grew in its former position. Too often a small hole is dug, the roots twisted so that they fit, a little soil placed on top, and the plant expected to flourish. By all means, have the hole sufficiently large to hold all the roots without crowding or bending. If the soil is packed or poor, dig the hole twice as large as necessary, replacing with new soil from the garden. A hole dug large enough for planting in good loose soil is shown in pl. 44, fig. C. At the left is a pile of top-soil, to be pulverized and placed around the roots before the pile of subsoil, on the right, is put back on top. When refilling the hole gently rock the tree back and forth, permitting the earth to fill in all around the roots and preventing the formation of pockets. These pockets occur when lumpy soil and chunks of sod are used to fill the hole. Grass or litter should not be permitted to come in contact with the roots. A heavy sod will heat, causing burning, while coarse litter prevents the soil from packing around the roots. After the hole has been refilled, pack the soil firmly around the roots by stepping on it and settle it by pouring on a bucket of water. A thick layer, three or four inches, of compost or manure will do much toward keeping the moisture supply constant and assist the plant to re-establish itself. Dynamiting is often used to loosen heavy soils before planting, but this is quite impractical when only a few trees are to be moved.

The moving of mature trees is beyond the scope of the BULLETIN. A number of reputable tree-moving firms operate in St. Louis, making it possible for us to have large trees on our lawns if we so desire.

When to Plant.—Although the time of transplanting has been briefly referred to above, the question would seem to be of enough importance to deserve more detailed consideration. Certainly there is hardly any one thing about which so many inquiries are received at the Garden. The difficulty, of course, is that it is impossible to predict what the succeeding season will be. If we could only know in the fall what kind of weather to expect in the coming winter or spring, very specific rules could be laid down. Since this is not the case in the vicinity of St. Louis, only general principles can be stated, recognizing that an unusually open winter or a very cold wet spring may upset the best-laid plans.

The time in which trees and shrubs in this locality may be moved is somewhat limited. Compared with the Eastern States the planting season is much shorter. In the fall the deciduous plants retain their foliage later in the season, often carrying into the period of freezing and thawing. In the spring the gradual passing of winter into summer is frequently so abrupt that transplanting must be done when the young growth is well advanced. This necessitates unusual watering and heavy pruning. In the fall the so-called Indian summer offers a longer period for transplanting, when many species may be moved with less risk. Specimen conifers, if the season's growth is well matured, have been successfully transplanted at the end of August or in early September. However, in general, evergreens may be transplanted with less danger in the spring than in the fall, particularly pines, hollies, spruces, arbor-vitaes, retinosporas, firs, and cedars. Since evergreens retain their foliage throughout the winter, the leaves make unusual demands upon the roots, the water often evaporating faster than it can be supplied by the mutilated roots. Even well-established evergreens, such as arbor-vitae and spruce, frequently show so-called "die-back"—a browning of the current season's growth. Specimens are submitted to the Garden to ascertain the disease involved, but almost invariably the main trouble proves to have been due to the plants going

PLATE 43.

A

DIGGING TREE FROM NURSERY SO THAT BALL IS PRESERVED.

B

ROOT PRUNING.

A
BEFORE PRUNING

B
AFTER PRUNING

C
TREE PLANTED ONE-HALF INCH LOWER THAN IN NURSERY ROW.

into the winter with too little water in the soil. A dry wind in early spring, with the ground dry or frozen, causes the tips of the branches to brown, not from disease or freezing but from drouth. The conifers at the Garden Extension at Gray Summit are well watered during the fall and the ground around each plant covered with a straw mulch. About 2000 young trees were transplanted to the new Pinetum in 1929, and despite their exposure to full sunshine, the loss so far has been negligible. On the other hand, during the fall of 1928 several hundred cedars which were dug from the glades near the Meramec River and planted along the Manchester Road where the necessary water could not be supplied showed a loss of sixty per cent.

Some of the deciduous shrubs show a greater mortality if planted in the late fall than in the spring. Fall-planted shrubs in many cases show a heavy freeze-back in the spring, especially if there has been a dry winter. If planted in the early fall and kept watered, there is time enough before the approach of extreme winter to repair the injury to the roots caused by digging and moving. If vacant spaces are left around the roots, due to imperfect firming of soil, the exposed roots dry up, reducing still further the chances of success. The roots are not nearly as apt to be harmed during the winter by freezing if there is close contact with the soil. Many experienced nurserymen in this vicinity prefer spring planting for those varieties of trees and shrubs most subject to winter killing, since extra attention and protection may thus be avoided. The following plants may be regarded as falling within this group: magnolia, lilac, *Cornus florida*, red-bud, willow, Lombardy poplar, birch, beech, tulip, and sweet-gum. The two last mentioned are regarded as the most difficult to move, either in spring or fall. For this reason the nurserymen offer these trees shipped B. B. (balled and burlaped), the same as evergreens.

It is not intended in this article to discredit fall planting. On the contrary, many plants will succeed if moved at this time of the year, and conditions may necessitate the transplanting of even those mentioned above in the fall rather than the spring. Extra precautions should be taken, however, to see that the trees and shrubs moved are not left to the mercy

of the elements before they have become established. The nurseryman should not be accused of disposing of inferior stock when the loss is due to neglect or an unwillingness to meet the extra cost of additional watering and winter protection.

A. P. B.
G. H. P.

NOTES

Dr. H. W. Rickett, assistant professor of botany, University of Missouri, visited the Garden library and herbarium, November 27-29.

Mr. George H. Pring, Superintendent of the Garden, lectured before the School of Design at the Soldan High School, December 16, on "House Plants."

Dr. Ernest S. Reynolds, Physiologist to the Garden, and Dr. Edgar Anderson, Geneticist, spoke over Station KMOX, December 15, on "Modern Miracles of Plant Science."

Mr. George H. Pring, Superintendent of the Garden, has been appointed chairman for 1931 of the School Gardens Committee of the Society of American Florists and Ornamental Horticulturists.

Dr. George T. Moore, Director of the Garden, gave a talk illustrated with moving pictures at the dinner of the American Society of Mechanical Engineers, December 12, on "Plant Growth."

Mr. L. P. Jensen, Arboriculturist to the Garden, served as one of the judges in the 1930 Roadside Beautification Contest, sponsored by the Missouri State Highway Department, December 10.

Mr. L. P. Jensen, Arboriculturist to the Garden, has given the following talks: "Roadside Beautification," at the dedication of a new road at Villa Ridge, Mo., October 18; "Trees," before the members of the Kirkwood Garden Club, No. 1, October 20; "The Value of a Garden Club and How It May be Organized," before a meeting of citizens of Washington, Mo., assembled to organize a Garden Club, October 22.

STATISTICAL INFORMATION FOR NOVEMBER, 1930

GARDEN ATTENDANCE:

Total number of visitors 60,384

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought 22
Total number of books and pamphlets donated 373

PLANT ACCESSIONS:

Total number of plants and seeds donated 37
Total number of bulbs donated 7,340

PLANT DISTRIBUTION:

Total number of plants distributed in exchange 39

HERBARIUM ACCESSIONS:

By Purchase—

Clemens, J. and M. S.—Plants of Borneo 687
Venturi, S.—Plants of Argentina 271

By Gift—

Drushel, J. A.—Plants of eastern United States 22
Fuller, H. J.—Plants of western United States 47
Kellogg, J. H.—Plants of Missouri 7

By Exchange—

California Academy of Sciences—Plants of California 117
Drushel, J. A.—Plants of eastern United States 216
Dudley Herbarium, Stanford University—Plants of Mexico 96
Kew Herbarium—Photograph of type of *Lycium macrophyllum* 1
U. S. National Herbarium—Umbelliferae 125

Total 1,589

Index to Illustrations

PAGE

Missouri Botanical Garden, airplane view of north half of the.... 1
Orchids, seeds of different genera of, showing characteristic structure of the seed coat..... 29
Orchid flower (*Cattleya Trianae*) showing desirable form for use in hybridizing..... 30
Orchid flower (*Brassocattleya Hyca*) showing undesirable traits 30
Orchid plant (*Cattleya Trianae*), bearing seed pod 10 months old 31
Orchid plant (*Dendrobium Phalaenopsis*), bearing seed pods 8 months old..... 31
Dendrobium hybrid seedlings, 4 months old..... 32
Cymbidium hybrid seedlings, transplanted, 5 months old..... 32
Brassocattleya hybrid seedlings, 3 months old..... 33
Dove orchid (*Peristeria elata*) seedlings, 5 months old..... 33
Phalaenopsis hybrid seedlings in one-inch pots, 10 months old... 34
Dendrobium hybrid seedlings in one-inch pots, 2 years old..... 34
Orchid seedling house No. 5, at Gray Summit, interior of..... 35
Orchid seedling house No. 2, at Gray Summit, interior of..... 35
Old Viburnum in need of renewal pruning..... 45
Renewal pruning 46
Viburnum bush before and after pruning..... 47
Water hyacinth in St. Johns River, Florida..... 48
Water hyacinth in the River Bremer, Queensland, Australia..... 48
Water hyacinth flowers, successive stages in the wilting of..... 49
Apocynum cannabinum, a typical colony of, growing near Carondelet, Missouri 87
Apocynum medium var. *lividum*, infesting a field near Bayfield, Colorado 90
Apocynum medium..... 91
Apocynum androsaemifolium..... 91
Apocynum androsaemifolium..... 96
Garden of A. D. Goldman, Clayton, Mo.....107
Garden of F. C. Thompson, Big Bend Road, Webster.....108
Saxifraga sarmentosa and *Pachysandra terminalis* in garden of F. C. Thompson.....109
Garden of Morton May, Brentmoor, Clayton.....110
Garden of Mark C. Steinberg, Warson Road, Clayton.....111
Garden of E. M. Funsten, Hampton Park, Clayton.....112
Garden of F. A. Brickenkamp, Clayton.....113
Garden and vicinity, view of south portion of.....119
Garden and vicinity, view of north portion of.....120
Glass garden two years old.....131
Glass garden six months old.....132
Glass garden one year old.....133
Glass gardens two months and two years old.....134
Selaginella grown in glass bowl for about two years.....135

Carpet bedding in Washington Park, Chicago, 1888.....136
Kinabureau of Netherlands, exhibit of propaganda material of...141
Merck & Co., cinchona exhibit of.....150
Dr. John Sappington, some of the relics of.....151
Dr. Sappington's prescription book and saddle bags.....152
Deciduous holly, fruiting specimen of.....157
Deciduous holly, flowering and fruiting branches.....158
Basket chrysanthemum "Anna".....159
Hanging basket. *Chrysanthemum indicum*.....160
Cascade chrysanthemum. "Ladysmith" front view.....161
Cascade chrysanthemum. "Ladysmith" side view.....162
Cascade chrysanthemums, group of.....163
Digging tree from nursery so that ball is preserved.....164
Root pruning.....164
Tree before and after pruning.....165
Tree planted one-half inch lower than in nursery row.....165

General Index

Figures in italics refer to page numbers of plates and cuts.

A

Achras Sapota, 65
Activities of Garden, exhibit in floral display house, 6
Aesculus, pruning, 46
Airplane view of north half of Missouri Botanical Garden, 1
Amateurs, spring course in gardening for, 2, 40
Amber, 76
Anderson, Dr. E., 14
Anemone, pronunciation of word, 124
Aniline dye, production of first, 145
Anniversary, three hundredth, of the first recognized use of Cinchona, 141; visitors at, 146; program of, 147
Annual bequests, 12
Annual report of the Director, 1
Apocynum; the genus, in Missouri, 93; primitive uses of, 89
Apocynum androsaemifolium, 91, 94, 96, 97, var. *incanum*, 99, 100; *cannabinum*, 90, 99, 101, a typical colony of, growing near Carondelet, Missouri, *87*, rubber content of, 92, var. *pubescens*, 99, 102, var. *glaberrimum*, 99, 101; *hypericifolium*, 98, 99, 103, var. *cordigerum*, 99, 103; *medium*, 91, 99, 100, var. *leuconeuron*, 99, 101, var. *lividum*, 88, infesting a field near Bayfield, Colorado, *90*
Apprenticeships, system of, at Garden, 3
Aronia, pruning, 46
Arsenical sprays, 39
Asclepias, rubber content of, 90, 91
Asymbiotic method of orchid germination, 35
Atropa Belladonna, 75
Attendance for the year 1929, 8
Awards to Garden in 1929, 6; given at National Orchid Show, 137
Azaleas, 6, 110

B

Bagworm control of the, 36
Bamboo, giant, 68
Bambusa arundinacea, 68
Bananas, 60
Banks', Sir Joseph, methods of growing orchids, 30
Baskets, exhibiting chrysanthemums in, 158, *159*, *160*
Begonias in glass gardens, 134
Belladonna, 75
Bernard's, Noel, orchid experiments, 34
Boresch's experiments with water hyacinth, 50
Brassavola, 32
Brassocattleya hybrid seedlings 3 months old, *33*
Brassocattleya Hyea, showing undesirable traits for hybridizing, *30*
Brassolaeliocattleya, 137
Bremer River, water hyacinths in, *48*, 49
Brickenkamp, F. A., garden of, 112, *113*
Bridal-wreath, pruning, 46
British Guiana, water hyacinths in, 48
Buckeye, pruning, 46
Bulb display, 6
Burgeff's experiments in orchid germination, 35

C

Cacti, grafted, 64
Calamites, 80

Calanthe Dominyi, 31; *furcata*, 31; *Masuca*, 31
Canizares, Don Juan Lopez de, 143
Carludovica palmata, 68
Carpet bedding, 135; in Washington Park, Chicago, 1888, *136*
Cascade chrysanthemums, 159, *161, 162, 163*
Caterpillars, bagworm, 37
Cattleya, 32, 126; *Bowringiana*, 136; *Dominiana*, 31; *intermedia*, 31; *maxima*, 31; X "Mona," 137; *Trianae*, 30, bearing seed pod 10 months old, *31*, showing desirable form for use in hybridizing, *30*
Cattleya orchid seedlings, 11
Cerbera Tanghin, 66
Cereus, night-blooming, 64
Chewing-gum tree, 65
Choke-cherry, pruning, 46
Christmas green, trailing, 125
Chrysanthemum "Anna," 158, *159*, "Benten," 160; "Buckingham," 160; "Columbia," 160; "Cosmos," 160; *indicum*, 160, *160;* "Ladysmith," 159, *161, 162;* "Melba," 160; "Molly Hunt," 160; "Old Gold," 160; "Roupel Beauty," 160; "Yellow Daisy," 158
Chrysanthemum show in 1929, 7; in 1930, 153
Chrysanthemums, cascade, 159 *161, 162, 163;* in baskets, 158, *159, 160;* novel methods of displaying, 158
Cinchona: the three hundredth anniversary of the first recognized use of, 141; discovery of, 141; exhibits of, *141 150, 151*, 152, *152;* use of, 141
Club moss, 125
Coal, 69, 77
Coffee, 59
Coffee and Banana House, 59
Cold storage house, completion of, during 1929, 8
Condamine, Marie de la, 143
Conifers, 80; at Gray Summit Extension, 10; transplanting, 164
Construction work at Garden during 1929, 8
Cooper's Joseph, discoveries in orchid growing, 30
Corn, 73
Cornus, pruning, 46
Cotton, 71
Cup, Mrs. F. E. Dixon, awarded Garden at National Orchid Show, 137
Cycads, 79
Cymbidium, 137; hybrid seedlings, transplanted, 5 months old. *32*
Cypress, bald, 79
Cypripedium Harrisianum, 31

D

Dahlia, 7, 124
Degrees in the Henry Shaw School of Botany, 15
Dendrobium, 31, 137; hybrid seedlings 3 years old, *34*, 4 months old, *32; Phalaenopsis* bearing seed pods 8 months old, *31*
Desert House, 62
Deutzia, pruning, 46
Dieffenbachia Seguine, 67
Digitalis, 75
Director, forty-first annual report of the, 1
Ditches, an excellent decorative plant for, 126
Dixon silver cup awarded at National Orchid Show, 137
Dogbane: roadside weed and future staple, 87; clasping-leaved, 103; intermediate, 100; prairie, 103; spreading, 100; velvet, 102; white-veined, 101
Dogwood, pruning, 46
Dominy, 31
Dumb-cane, 67
Dutch cultivation of Cinchona, 144

E

Economic garden, 5, 70
Economic House, 65
Eichhornia paniculata, 50; *speciosa*, 48, 50
Epigaea repens, 109
Erica cinerea, 110
European representative of Garden, work of, 12

F

Fashions in flowers, 135
Fellows in the Henry Shaw School of Botany, 15
Fern House, 69
Ferns for glass gardens, 134
Fiber, dogbanes as a source of, 89, 92
Floral displays in 1929, 6
Flower sermon, annual, 12
Flower shows at Garden, 7
Forsythia, frozen, treatment of, 52
"Fossils, living," in the Missouri Botanical Garden, 76
Frozen hedges and shrubs, 51
Fruit trees at Gray Summit Extension, 11
Fungous pests at Garden in 1929, 2
Fungus, relation of a, to orchid germination, 34
Funsten, E. M., garden of, 112, *112*

G

Gallaud's experiments with the orchid fungus, 34
Gardener's Monthly and Horticultural Adviser, early account of Garden in, 119
Gardening: elementary spring course in, for amateurs, 40; instruction in, 2
Gaultheria procumbens, 109
Ginger plant, 65
Ginkgo tree, 78
Glad-e-ó-luss or Glad-eyé-o-luss?, 122
Glass gardens: for the home, miniature, 131; two years old, *131;* six months old, *132;* one year old, *133;* two months old, *134;* two years old, *134*
Golden-bell, treatment of frozen, 52
Goldman, A. D., garden of, *107*, 108
Graduate students in Shaw School of Botany in 1929, 15
Grafted cacti, 64
Gray Summit Extension, 10; greenhouses at Gray Summit Extension, 11; the home of a wealth of wild flowers, 113; interior of orchid seedling house at, showing hybrid seedlings, *35;* spring wild flowers blooming at, 82; wild flowers at the, 126
Greenhouses at Gray Summit Extension, 11
Greenman, Dr. J. M., 13

H

Hanging baskets of chrysanthemums, 158, *160*
Heating system at Garden, improvement in, during 1929, 9
Hedges, frozen, treatment of, 51
Hemp: Indian, 87, 101; Canadian, 102
Herbarium, report of, for 1929, 20; exchange of specimens, 22; field work during 1929, 22; mounting and inserting of specimens, 21; new accessions, 20; reorganization of specimens, 22; statistical summary, 23; use of herbarium by outside botanists, 22
Hog Hollow (Jefferson County), spring wild flowers blooming at, 83
Holly, deciduous, 157, *157*, *158*
Honeysuckle, treatment of frozen, 53
Horsetails, 80
Hybrids, orchid, 31
Hydrangea paniculata, pruning, 46

I

Ilex decidua, 157, *157*, *158*
Insect-catching habit of Apocynum, 94, *97*
Insects and fungous pests during 1929, 2
Instruction: in gardening, 2; in the Henry Shaw School of Botany, 14
Iris test garden, 5
Italian garden, 5

J

"Jardin des Plantes of the United States," 121
Java, cinchona growing in, 144
Jesuits bark, 142

K

Kalmia latifolia, 110
Kerria, pruning, 46
Kinabureau of Netherlands, exhibit of propaganda material of, *141*, 152
Knudson, asymbiotic method of germinating orchids developed by, 35

L

Laelia, 31
Laeliocattleya, 137
La Garde, Dr. Roland V., 14
Latin names of plants, 123
Lectures, scientific and popular, by members of staff during 1929, 17
Lepidendrons, 80
Library, report of, for 1929, 23; Garden publications, 25; new accessions, 25; statistical information, 26; use of the library, 24
Ligustrum "Ibolium," 52; *Ibota*, 52; *ovalifolium*, 52
Lilac, pruning, 46
Lilies, 110
Lily bulbs at Gray Summit Extension, 10
Linder, Dr. David H., 14
Lindley's observations on orchids, 30
Linnaeus' spelling of Cinchona, 143
Linnean garden, 4
Lonicera fragrantissima, treatment of frozen, 53
Lycopodium clavatum, 125; *complanatum*, 125; *lucidulum*, 125. var. *porophilum*, 125

M

Maidenhair tree, 78
Maple, tall, in New England, 88
Markham, Sir Clements, 144
Masdevallia, 31
Massachusetts Horticultural Society flower show, 6
Mathias, Dr. Mildred E., 14
May-apple, 75
May, Morton, garden of, 110, *110*
Medals: awarded Garden in 1929, 6; of American Orchid Society, 137
Medicinal plant garden, 5, 74
Medicinal use of *Apocynum cannabinum*, 90
Merck & Co., quinine exhibit of, *150*, 152
Miniature glass gardens for the home, 131
Missouri Botanical Garden: airplane view of north half of the, *1*; and vicinity, 1875, view of south portion of, *119*, of north portion, *120*; and the St. Louis schools, 57; exhibit of orchids at orchid show, 137
Mock-orange, pruning, 46
Moss, club, 125
Mosses used in Wardian cases, 133
Mother-in-law plant, 67
Museum, Henry Shaw, 3

N

Narcissus bulbs at Gray Summit Extension, 10
National Orchid Show, 136
Navigation, a plant that stopped, 48
Neottia, 34
Nine-bark, pruning, 46
Nursery at Gray Summit Extension, 10

O

Oak, pin, pruning, 47
Odontoglossum, 136
Oncidium, 137
Orchid: hybrids, 31; seedlings at Gray Summit Extension, 11, *34*; dove, seedlings 5 months old, *33*; show, the national, 136; show at Garden, 6
Orchids: flowering, exhibited by Garden at St. Louis Horticultural Society spring show, 6; from seed, exhibit illustrating, 137; growing of, from seed, 29; growth of, from seed to flower, Garden exhibit showing, 6; seeds of different genera showing characteristic structure of the seed coat, *29*
Ordeal plant, 66

Ornamental trees and shrubs, pruning, 45
Osage Hills, Mo., spring wild flowers found in, 82
Outdoor planting, 4

P

Pachysandra terminalis, 109
Pacific, Mo., spring wild flowers blooming at, 83
Palm: bamboo, 68; date, 67; seedlings in glass gardens, 134; Panama-hat, 68
Palm house, 67
Paphiopedilum, 136
Paris green for spraying the bagworm, 39
Paxton's methods of growing orchids, 30
Pelletier and Caventou, placques of, 152
Pepper, black, 66
Peristeria elata, 11; seedlings 5 months old, *33*
Phalaenopsis, 137; hybrid seedlings, 10 months old, *34*
Philadelphus, pruning, 46
Phoenix dactylifera, 67
Physocarpus, 46
Pine: trailing ground, found for the first time in Missouri, 125; trees, 80
Piper nigrum, 66
Plant that stopped navigation, 48
Planting, outdoor, in 1929, 4
Podophyllum, 75, 90
Poinsettia display, 6
Pools, tropical, reconstruction of, 8
Poplar, Lombardy, 88
Potinera, 32, 137; seedlings, 12
Prickly pears, 63
Privet, California, 51; treatment of frozen, 52; "Ibolium," 52
Pruning, 162, *164*, *165;* "corrective," 47; renewal, 46, *46;* of ornamental trees and shrubs, 45; root, 162, *164*; Viburnum in need of, *45*
Published articles by members of staff during 1929, 16

Q

Queensland, Australia, water hyacinth in, 48, 49
Quinine, propaganda material of, *141*

R

Rankin Estate, spring wild flowers blooming at, 83
Ranunculus repens, 126
Records of first blooming of wild flowers in the vicinity of St. Louis, 82
Red-bud, 53
Renewal pruning, 45, 46, *46*
Research and instruction during 1929, 13
Reynolds, Dr. E. S., 13
Rhododendron, 110; dell at Gray Summit Extension, 10
Rice, 71
Roads at Gray Summit Extension, 10
Rock garden at Gray Summit Extension, 10; for St. Louis and vicinity, 107
Rolfeara, 137
Roses: damage to, by storm of May 2, 1929, 4; treatment of frozen, 53; winter treatment of, 155
Rubber content of *Apocynum androsaemifolium*, 91
Rushes, 80

S

Saint John's River, Florida, water hyacinths in, 48, *48*
St. Louis and vicinity, rock gardens for, 107
St. Louis College of Pharmacy, medicinal plants used by, 5
St. Louis Horticultural Society spring show, Garden exhibit of flowering orchids at, 6
St. Louis, records of first blooming of wild flowers in the vicinity of, 82
St. Louis schools, the Missouri Botanical Garden and the, 57
Sapodilla plum, 65

Sappington, Dr. John, some of the relics of, *151*, 152, *152*
Saxifraga sarmentosa in flower, 109, *109;* rock ledge planted with, *109*
School for Gardening, 2
School of Occupational Therapy, courses offered to students in, 3
Schools, the Missouri Botanical Garden and the, 57
Selaginella grown in glass bowl for about two years, *135*
Shade house, 9
Shaw Museum, 3
"Mr. Shaw's Garden", the early days of, 119
Shrub, a large, for the garden, 157
Shrubs: frozen, 51; pruning, 45, *45*, *46*
Snowball, see Viburnum
Snowstorm of May 2, 1929, damage to plants at Garden by, 1
Sonchus oleraceus, 92
Sophronitis, 32
Spiraea, pruning the, 46
Spraying: for the bagworm, 39; for scale, 154
Spring course in gardening for amateurs, 40
Spurges, 64
Stapelias, 64
Statistical information for December, 1929, 27; January, 1930, 43; February, 55; March, 85; April, 105; May, 118; June-August, 129; September, 140; October, 156; November, 167
Steinberg, Mark C., garden of, 111, *111*
Sumac, fragrant, 53
Sweet-gum, pruning, 47
Sycamore, 161; before and after pruning, *165*
Symbiotic method of orchid germination, 35
Syringa, pruning, 46

T

Thompson, F. C., garden of, *108*, 109, *109*
Tiger apple, 66
Tobacco, 73
Trailing ground pine, 125
Transplanting trees and shrubs, 162, *164*, *165*
Trees: damage to, by snowstorm of May 2, 1929, 2; and perennials, plantings of, at Gray Summit Extension, 10; care of, during 1929, 5; pruning, 45; and shrubs, transplanting, 162
Tropical Station, Missouri Botanical Garden, 12
Tulip tree, pruning, 47

V

Vanda, 137; *Lowii*, 136; *Sanderiana*, 11
Viburnum, 46: bush, before pruning, *47*, after pruning, *47;* in need of renewal pruning, *45*

W

Wahrlich's observations on orchid culture, 34
Ward, Nathaniel, 131
Wardian cases, 131, making of, 132
Warnings for winter, 154
Water hyacinth, 48: a year's growth in the River Bremer, Queensland, Australia, 48; in St. Johns River, Florida, 48; successive stages in the wilting of flower, *49*, 51
Weather in St. Louis during 1929, 1
Wheat, 70
Wild flowers: at the Gray Summit Extension, 126; Gray Summit Extension, the home of a wealth of, 113; records of first blooming, in the vicinity of St. Louis, 82
Wilson, Mr. Gurney, work of, 12
Winter, warnings for, 154
Wisteria, spelling of name, 124
Woodson, Dr. Robert E. Jr., 14

Y

Yucca plant, fabrics from, 89

Z

Zingiber officinale, 65
Zygopetalum, 11, 137

FLORAL DISPLAYS OF SPECIAL INTEREST IN 1930

In order that readers of the BULLETIN may have a more comprehensive idea of the various flower shows and outdoor exhibits which from month to month may be seen at the Garden, the following tentative schedule is given. While the indoor exhibits can be quite definitely indicated, the blooming period of outdoor plants is subject to variation, depending upon the weather, and out-of-town readers should confirm the date of any display before visiting the Garden.

JANUARY

(Floral Display House)
Orchids, Primroses, and Cyclamen.

FEBRUARY

(Floral Display House)
First half month—Orchids.
Second half month—Cinerarias.

MARCH

(Floral Display House)
March 1-17—Bulb Show.
March 20-23—St. Louis Florists' Show.
March 29—Azalea Show.

APRIL

(Floral Display House)
Azaleas, Roses, Schizanthus.
(Outdoors)
Pansies, English Daisies, Early-flowering Shrubs.

MAY

(Floral Display House)
Hybrid Pelargoniums, Salpiglossis, Begonias, Marguerites, Lupines, and other spring annuals.
(Outdoors)
Bulbs (early in month), Hardy Water-lilies, Peonies.
Iris (late in month), Spring-flowering shrubs and perennials.

JUNE

(Outdoors)
Roses, Hollyhocks. Medicinal Garden.

JULY

(Outdoors)
Tropical plants. Annuals. Economic Garden—farm crops, fiber plants, rice, cotton, peanuts, tobacco, sugar-cane. Medicinal Garden.

AUGUST

(Outdoors)
Tropical Water-lilies, Victoria Cruziana, Lotus lilies. Economic Garden. Medicinal Garden.

SEPTEMBER

(Outdoors)
Tropical Water-lilies. Economic Garden. Medicinal Garden.

OCTOBER

(Floral Display House)
Dahlia (novelties and newer varieties).

NOVEMBER

(Floral Display House)
Chrysanthemum Show.

DECEMBER

(Floral Display House)
Poinsettias, Stevias.

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove avenue and Flora place, on the Sarah car line (No. 42). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motorbus lines transfer.

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